The human papillomavirus immunisation programme and sexual behaviour

Alice Susan Forster

University College London

A thesis submitted for the degree of Doctor of Philosophy

DECLARATION

I, Alice Susan Forster, confirm that the work presented in this thesis is my own. Where information has been derived from other sources, I confirm that this has been indicated in the thesis.

ACKNOWLEDGEMENTS

I would like to thank the following people and organisations for making this thesis possible. Firstly I would like to thank my supervisors Jo Waller, Jane Wardle and Judith Stephenson. Jo, I have really enjoyed my PhD with you. Your calming approach has made my PhD seem more manageable and I really appreciate that you have always had time for me. Jane, I have learnt so much from your experience and wealth of knowledge.

Thank you to Laura Webber, Laura Marlow, Emily, Clare and Gareth. Your support and guidance has been invaluable and I could not have completed this thesis without having you here every day for the last three years. To Chloe, thank you for your generosity, friendship and for being there for me unfailingly. Meeting and working with all of you has been an unexpected and wonderful benefit to deciding to do a PhD.

I would like to say thank you to all of my colleagues at the Cancer Research UK Health Behaviour Research Centre for their help with data collection and for creating a wonderful environment to carry out a PhD. Special thanks to Cindy Li, Adrian de Mello and Jenny Taylor for their help with data entry. I am also grateful to the UCL Medical School for awarding me with the Dean's studentship which has funded this PhD and to GlaxoSmithKine for funding the study presented in Chapter 5. Thanks also to the individuals and colleges that have participated in this research.

Thank you to Alaina, Charlie, Oli and Sarah. Your friendship, support and welcome distraction has ensured that my PhD has not been all encompassing.

I would like to say thank you to Rob and Sophie, perhaps most importantly, for providing me with perspective, and finally, thanks to Mum and Dad. Thank you for learning, understanding and listening.

ABSTRACT

The introduction of human papillomavirus (HPV) vaccination has caused some parents to report concern that their daughters may change their sexual behaviour following vaccination. This concern consistently relates to vaccination acceptance, but had not been investigated in detail. Accordingly, five studies addressed the thesis objective: to explore parents' concern about adolescent sexual behaviour following HPV vaccination in the context of the UK immunisation programme and to examine whether such concerns were justifiable.

The first study examined discussions of risky sexual behaviour and HPV vaccination in news articles published over five years in British newspapers. The second study investigated mothers' concern about their daughters engaging in risky sexual behaviour after vaccination by questioning a sample of mothers. The third study explored whether adolescents would interpret vaccination consent from parents as *carte blanche* approval for sexual activity, by surveying 162 girls. The fourth study prospectively investigated the impact of HPV vaccination and a fifth study compared differences between vaccinated girls and girls who had not been offered the vaccine.

Concern about the impact of HPV vaccination on sexual behaviour was raised and countered in the media. A minority of mothers were apprehensive about girls' sexual behaviour following vaccination, however these concerns did not relate to vaccine acceptance. Before the vaccination programme was introduced, some adolescents would infer implicit consent to sexual activity if their parents were to consent to vaccination but most would also take positive messages. Once the HPV immunisation programme was underway, girls' sexual behaviour did not become more negative following vaccination, despite perceptions of risk lowering. Parents' concerns may have resulted in reluctance to discuss sex with their daughters in the context of HPV vaccination so that implicit messages of approval for sexual activity are not conveyed. Risk perceptions were pertinent in HPV vaccination acceptability and when exploring behaviour change. These findings may help reduce resistance to HPV vaccination. Implications for theory and practice are discussed.

TABLE OF CONTENTS

LIST OF APPENDICES

LIST OF TABLES, FIGURES, GRAPHS AND BOXES

Chapter 1 - Background

CERVICAL CANCER AND HUMAN PAPILLOMAVIRUS (HPV)

Incidence and mortality

Each year around 2,300 women in England are newly diagnosed with cancer of the cervix and in 2008 759 women died as a result of the disease (The Information Centre, 2009b). Worldwide incidence of the disease in 2002 was estimated at 493,000, with 274,000 deaths attributable to the disease (Ferlay et al., 2004).

Causes

Human papillomavirus

It has been estimated that 5.2% of all cancers worldwide are caused by human papillomavirus (HPV; de Sanjose et al., 2007; Parkin, 2006). There are over 130 types of HPV which can be classified as low- and high-risk: low-risk types cause benign warts (predominantly types 6 and 11 in the case of condyloma acuminata), high-risk types are carcinogenic agents. Around 15 oncogenic HPV types have been identified. High-risk HPV types are responsible for over 99% of the two main types of cervical cancers (squamous cell carcinoma and adenocarcinoma; Walboomers et al., 1999) with types 16 and 18 involved in 70% of all cervical cancers (Parkin & Bray, 2006). More recent data has suggested that this may be even higher with 76% of squamous cell carcinomas and 82% of adenocarcinomas being caused by types 16 and 18 (Howell-Jones et al., 2010). HPV types have also been associated with the development of cancers of the vulva, vagina, anal canal, perianal skin and penis, and possible associations have been noted with cancers of the skin, oral cavity and upper aerodigestive tract (Parkin, 2006). The virus is very common; 80% of sexually active individuals will be exposed to HPV in their lifetime (Monsonego, 2007, p.190) and at any time point, 10.4% of females worldwide have cervical HPV infections (de Sanjose et al., 2007). Infection often occurs soon after sexual debut; a study of sexually naïve women found 38% to be infected with one HPV type within one year of sexual debut (Winer et al., 2003).

HPV is normally spread by skin-to-skin contact and transmission of the virus to the cervix is usually via sexual contact but not necessarily penetrative sexual intercourse. Consistent

condom use offers some protection from HPV infection (Winer et al., 2006). In the case of cervical cancer the virus penetrates cervical epithelial tissue cells causing the cells to mutate as the virus replicates its DNA in the cell's nucleus, starting the process of dysplasia or cervical intraepithelial neoplasia (CIN). Full integration of the virus does not occur in low-risk HPV types and hence the cells remain benign. Initial infection with HPV can be latent and can remain so for many years; latent HPV is not infectious and is asymptomatic. In 80-90% of cases, the individual's immune system spontaneously rids the body of the virus or HPV DNA can no longer be detected (Stanley, 2006). Persistent infection with HPV can cause mild dysplasia (CIN1), potentially progressing to higher grade CIN disease (CIN2 and CIN3), which if left untreated, may develop into cancer of the cervix (Stanley, 2008). The duration of the process of infection with HPV to the development of CIN3 is not completely clear. Cross sectional data give estimates anywhere between 7-15 years but prospective cohorts have found it can be as little as four months (Bosch & de Sanjose, 2003; Winer et al., 2005).

Risk factors

A number of factors have been established to increase a woman's chance of becoming infected with HPV and developing high-grade CIN disease.

Risk factors for infection

Factors which increase a woman's chance of becoming infected with HPV tend to relate to her sexual history or the sexual history of her partner. These risk factors include having many sexual partners (sometimes identified as more than six), a history of previous miscarriage, earlier sexual debut, and an increased risk that her partner is an HPV carrier (Deacon et al., 2000; Kjaer et al., 2001).

Risk factors for developing high-grade CIN disease

Infection with HPV is necessary for the development of high-grade CIN disease and cervical cancer; however epidemiological studies and have identified a number of other factors that increase the risk of an HPV infected woman developing the disease. These factors include her sexual lifestyle, co-infections, health behaviours and demographic

factors. Women who have a younger sexual debut, a younger first full-term pregnancy, have used oral contraceptives for longer than five years and started a new sexual relationship more than six years ago are more likely to develop high-grade disease (de Gonzalez & Green, 2007; Deacon et al., 2000; Moreno et al., 2002). There is also a positive correlation between risk of high-grade disease and both the number of sexual partners a woman has and her parity. The sexual lifestyle of a woman's male partner (for example number of his sexual partners, number of prostitutes as sexual partners, and being a carrier of a high-risk HPV type) can increase the likelihood that she develops CIN3/cervical cancer (Bosch et al., 1996). Women with a circumcised male partner are less likely to develop cervical cancer (and be infected with HPV; Castellsague et al., 2002). Pooled analysis of international epidemiological studies have found co-infection with chlamydia trachomatis to be associated with squamous cell cervical carcinoma, but not adenocarcinoma (Smith et al., 2004a). Herpes simplex virus-2 is associated with both histological types (Smith et al., 2002) and human immunodeficiency virus infection (HIV) increases the risk of high-grade disease (Palefsky, 2006). Immunosuppression in its own right increases the risk of HPV-related lesions and detection of HPV (Palefsky & Holly, 2003). Research is investigating at what stage of the development of cervical cancer, HIV and immunosuppression are involved, and what role they play at each stage. Smoking also increases a woman's risk of developing high-grade disease (Appleby et al., 2006; de Gonzalez & Green, 2007). Finally, geographical location and socio-economic status (SES) are associated with development of the disease independently of other lifestyle factors (de Gonzalez & Green, 2007; Quinn et al., 2001).

Prevention

Cervical screening

Organised cervical screening programmes operating call-and-recall systems with systematic follow-up are available in some developed countries, such as Finland, Iceland and some developing South American countries (Sankaranarayanan et al., 2001). Less effective unorganised programmes are available to women in other developed countries such as the USA. Screening programmes of any kind are much rarer in developing countries, particularly those in Sub-Saharan Africa and India, where the burden of disease is greatest.

Since 1988, the National Health Service (NHS) cervical cancer screening programme has operated a call-and-recall system inviting women registered with a GP to attend cervical screening every 3-5 years. The age that women are first invited varies across the UK: in England first invitations are sent at age 25 whereas in Wales, Northern Ireland and Scotland first invitations are sent at age 20. Women are no longer invited for screening after age 64 if they have had three consecutive negative results (age 65 in Northern Ireland and 60 in Scotland). The programme aims to detect and treat any abnormal changes in cells in the cervix before they develop into high-grade disease, and can reduce the incidence of cervical cancer by up to 73% (Sasieni et al., 2003). During the procedure a nurse or doctor takes a sample of cells from the cervix, which is prepared using liquid based cytology for analysis in a laboratory[1]. A sample prepared for liquid based cytology is preserved in fluid immediately after it has been taken. It is then sent to a laboratory where it is transferred to a slide for examination under a microscope.

Women receive their results in writing within four to six weeks of their appointment (depending on their geographical location). Cases of mild dyskaryosis or more advanced abnormalities are further examined by colposcopy and treated according to the results of this investigation. HPV-DNA can be detected in cellular specimens taken from the cervix. In order to reduce the number of referrals for colposcopy, the NHS in England are evaluating testing of borderline and mild dyskaryotic cervical screening samples for HPV-DNA. If HPV-DNA is not detected, the woman is unlikely to develop cervical cancer and she will be returned to 3-5 year screening. Women with samples showing evidence of HPV-DNA will be referred for colposcopy.

In 2008/2009, 79% of eligible women in England were less than five years since their last cervical screening appointment (73% in Scotland in 2008, 71% in Northern Ireland in 2004;

1 Before liquid based cytology was introduced in the UK, the sample would have been immediately smeared onto a slide after it had been taken and sent to the laboratory in this form. As a result, in the UK, cervical cancer screening is commonly known as a ‘smear test’, although the procedure of smearing the sample on to a microscope slide is no longer used.

Cervical Screening Wales, 2010; Information Services, 2009; Public Health Agency for Northern Ireland, 2006; The Health and Social Care Information Centre, 2009). However, coverage rates have fallen in the last 10 years in England, with young women being less likely to attend (The Health and Social Care Information Centre, 2009). In 2009 66% of 25-29 year olds had attended screening in the last five years compared with 78% in 1999.

Prophylactic vaccination

Two, highly effective, virus-like particle (VLP) prophylactic HPV vaccines that protect against the two most common high-risk HPV types (16 and 18) have recently been developed (known commercially as Gardasil® and Cervarix®). Gardasil® also protects against HPV types that cause 90% of genital warts (types 6 and 11), making it a quadrivalent vaccine as opposed to a bivalent vaccine. There is evidence that both vaccines offer some cross-protection against HPV types not specifically targeted by the vaccine (Brown et al., 2009; Paavonen et al., 2009; Wheeler et al., 2009), but it is unknown how long this protection lasts for or whether the protection will be clinically meaningful (Franceschi, 2009). Second generation HPV vaccines will target more HPV types and are currently being evaluated. The quadrivalent and bivalent vaccines in use today have proved safe and are close to 100% effective; preventing up to 70% of cervical cancers if given to individuals naïve to infection (this is normally equivalent to never having sexual contact; Rambout et al., 2007). The bivalent vaccine has shown poorer efficacy in intention to treat analysis (The FUTURE I/II study group, 2010). Both vaccines are administered three times over a six month period and are known to offer greater than 98% protection against HPV types 16 and 18 over five to seven years. It is likely that protection will extend well beyond this, although data are not currently available (De Carvalh et al., 2009; Villa et al., 2006).

The UK HPV immunisation programme

The NHS in Great Britain and Northern Ireland recommends and offers a number of immunisations to all children (the childhood immunisation schedule). The vaccinations are provided without financial cost at the point of receipt. In September 2008, the HPV vaccine was included in the UK childhood immunisation schedule and it is the UK HPV immunisation programme that is the focus of this thesis. The routine HPV immunisation

programme offers the vaccine to all girls in school year 8 (12-13 years old) and in most cases is administered in schools. Ordinarily the girl's parents or guardians must 'opt-in' to vaccination[2]. A one-off, two-year 'catch-up' programme to include all girls not included in the main programme and who were born after 1st September 1990 (2nd July 1990 in Northern Ireland) was also introduced in September 2008. In the first year of the 'catch-up' programme girls born between 1st September 1990 and 31st August 1991 (school year 13) were offered the vaccine. In the second year of the programme, girls born between 1st September 1991 and 31st August 1995 were offered the vaccination. Girls in the 'catch-up' cohort were offered the vaccine either in their educational establishment or through their GP; dependent on their local primary care trust (PCT) and whether they continued into post-16 further education. Initially, the government planned a phased roll-out of the 'catch up' programme that offered the HPV vaccine to a different school year group each academic year. This schedule was amended at the end of the first year of the immunisation programme so that all girls due to be offered the vaccine as part of the 'catch-up' programme would do so in the second year of the programme.

The UK government chose to use the bivalent vaccine (Cervarix®) in its immunisation programme and is not offering the vaccine to boys, which has caused considerable discussion. The quadrivalent vaccine is licensed for use in males in over 40 countries, including the UK, and the US Food and Drug Administration (FDA) has recommended the quadrivalent vaccine for genital wart prevention (European Centre for Disease Prevention and Control (ECDC), 2010; Koulova et al., 2008). It has been estimated that inclusion of males into the UK immunisation programme is not cost effective for the reduction of cervical cancer if over 75% of eligible females are fully vaccinated (Kim & Goldie, 2009). However, others argue that excluding males from the programme strengthens societal beliefs that sexual health is the woman's responsibility (Szarewski, 2008). As the focus of the UK HPV immunisation programme has been on cervical cancer prevention, HPV

[2] Girls under the age of 16 in England and Wales have the legal right to confidential healthcare without parental consent if they are considered to be competent in understanding the information given to them, including the risks and alternatives, and can make a balanced decision; termed 'Gillick competent'. Similar premises are used in Scotland (HMSO Stationery Office, 1991). However, the application of Gillick competence is contentious as there is no appropriate legal framework in the UK for determining 'mental capacity' in children.

vaccination in males and HPV vaccination for the prevention of genital warts has not been addressed in this thesis, because beliefs about these issues are unlikely to reflect the experiences of parents and girls involved in the British programme.

Uptake of the HPV vaccine

To maximise the efficacy of the programme, uptake of the vaccine needs to be high; 80% vaccination coverage would result in a 63% reduction in cases of invasive cervical cancer and 70% coverage would result in a 55% reduction (Cuzick et al., 2010). In the first year of the routine HPV immunisation programme in England, 80.1% of girls born between 1st September 1995 and 31st August 1996 (school year 8) received all three doses of the vaccine (Department of Health, 2010). Uptake was higher for the first two doses (86% received doses one and two). Uptake varies across the country, being highest in Poole PCT (98.9% received three doses) and lowest in Luton PCT (44.1%)[3]. Preliminary data for uptake in the other countries of the UK show that since September 2008 89.4% of 12-13 year olds in Scotland had received two doses of the vaccine, 78.8% of 13-14 year old girls had received two doses in Northern Ireland, and 79% of 12-13 year old Welsh girls had completed the full programme (NHS National Services Scotland, 2008; Northern Ireland Executive, 2009; National Public Health Services for Wales, 2009). Uptake of the HPV vaccine in the first year of the 'catch-up programme' was considerably lower, with 31.8% of girls born between 1st September 1990 and 31st August 1991 receiving all three doses. Just over 54% received the first two doses of the vaccine.

In the USA the vaccine is not being delivered in schools. In 2008, 37.2% of eligible 13–17 year old Americans had initiated the three dose vaccination series and 17.9% had completed it (Centers for disease control, 2009). In Australia the vaccine is being delivered in schools. In the first year of this programme between 75 and 80% of 11-12 year old girls received the vaccine, varying by state and territory (Shefer et al., 2008). In Canada, one study has suggested that uptake of the HPV vaccine has been lower than for other vaccines offered during adolescence. Ogilivie et al. (2010) reported that 65% of 11-12 year olds in

[3] Bassetlaw PCT in the East Midlands reported three-dose uptake as .03% but this is likely to be due reporting or implementation differences by the PCT rather than decisions of parents not to vaccinate.

British Colombia had received the HPV vaccine, compared with 88% and 87% who had received the Hepatitis B vaccine and Meningitis C vaccine respectively.

The HPV vaccination in the UK in context

Accompanying the introduction of the HPV vaccine, the Department of Health in England dedicated resources to raising awareness of the vaccine to parents and girls themselves and promoting its use. Television and radio advertisements were broadcast, leaflets were distributed, and poster advertisements were displayed in prominent places such as bus stops. Girls were also encouraged to set up text message reminders for each vaccination dose. Similar campaigns were launched in Scotland, Wales and Northern Ireland.

In August 2008, one month prior to the introduction of the HPV vaccine in the UK, a reality television personality, Jade Goody, received a diagnosis of cervical cancer live on television. A television programme documented Jade's life in the following months, filming her learning that the cancer had metastasised and covering events right up until her death in March 2009. Newspapers, magazines and other television programmes also covered this news story. Jade Goody was a highly visible individual to young women and her experience with cervical cancer was credited as the cause of an increase in cervical cancer screening attendance in 2008/2009, especially in younger age groups (The Information Centre, 2010a). Her death was likely to have had a similar influence on HPV vaccination uptake, although figures were not available to confirm this.

In contrast, in September 2009 a 14-year old girl from Coventry died after receiving the HPV vaccine (The Guardian, 2010). Considerable media coverage raised the profile of this event and the immunisation programme was temporarily suspended in Coventry Teaching PCT. Post-mortem examinations revealed that the girl had died from a malignant tumour in her chest and that the HPV vaccine had not contributed to her death. This event is likely to have caused temporary or permanent concern about the vaccine and had the potential to affect vaccination uptake negatively.

Experience of childhood immunisation in the UK

Given that the HPV vaccination has only recently been introduced, it is instructive to look at the experience of vaccines that are more established in the childhood immunisation programme, and the broader context of vaccination in the UK, to help understand problems that may be encountered with the introduction of a new vaccine. Presently, a programme of 11 vaccines is offered to children as part of the UK childhood immunisation schedule that provides protection from 11 illnesses (some of these are combined vaccines). The vaccines include: diphtheria, tetanus, acellular pertussis/inactivated polio vaccine/Haemophilus influenzae type b, DTaP/IPV/Hib; pneumococcal conjugate, PCV; meningitis C, MenC; measles, mumps and rubella, MMR and also now HPV. Table 1.1 shows the uptake of these vaccines by 2 years of age. Children are offered a booster dose of the tetanus, diphtheria and polio vaccine when they are age 13-18 and uptake of this booster dose would be a useful age-appropriate comparison with HPV uptake, however percentage uptake is not currently reported by the Health Protection Agency due to reporting issues and because it has been difficult to determine an accurate denominator as the vaccine can be received at any age between age 13 and 18. As can be seen from Table 1.1, on the whole, uptake of these vaccines has been high, although MMR vaccination uptake is much lower.

In 1998, a study was published in The Lancet that investigated chronic enterocolitis and regressive developmental disorder. Although the authors did not link autism and the combined MMR vaccine in this paper, this interpretation was made by others, including in the media. The study was subsequently discredited, and retracted by the journal in 2010. The media's persistent and sometimes frenzied response to this study was significant in raising panic in parents. In presenting a so-called, balanced argument, with the opinions of anti-vaccination groups as well as the medical establishments, parents were led to believe that there was uncertainty in the scientific community about the safety of the vaccine (Speers & Lewis, 2004). There was a substantial fall in uptake of the MMR vaccine following the publication of this study: prior to its publication around 92% of 2 year olds were receiving the MMR vaccine; media coverage peaked in 2002, and in 2003/2004 only 80% received the vaccine. Over 10 years later still only 85% of infants have received the vaccine, short of the 90% uptake needed to ensure herd immunity. This contrasts with

uptake of other childhood immunisations which are consistently above 90% (Health Protection Agency, 2010). A similar case was seen with pertussis (whooping cough) vaccination in the UK (and internationally) in the late 1970s. Following suggestions that the vaccine caused brain damage, uptake of this particular vaccine fell from around 80% to 31% (Health Protection Agency, 2010) while uptake of other vaccines remained constant (around 80%). Both instances illustrate the substantial impact that single issues, when given sustained media coverage, can have on the uptake of specific vaccines, with this effect being enduring.

Table 1.1 - Completed primary courses at two years of age in England 2008/2009 (Health Protection Agency, 2010; The Information Centre, 2009a)

	Diphtheria, tetanus, acellular pertussis/inactivated polio vaccine/Haemophilus influenzae type b (DTaP/IPV/Hib)	Measles, mumps and rubella (MMR)	Meningitis C (Men C)	Pneumococcal conjugate (PCV)
Uptake	94%	85%	92%	91%

The role of health psychology in understanding HPV vaccination uptake

Health psychologists have been involved in evaluating the psychosocial issues related to cervical cancer prevention for a number of years. Research in this area has improved understanding of women's experiences of participating in the different areas of cervical cancer prevention. Such research has previously focused on HPV testing, cervical cancer screening and biobehavioural factors involved in preventing HPV infection and the development of high-grade disease (see Waller et al., 2004). More recently, psychosocial research has examined parents', non-parent adults', healthcare professionals' and girls' attitudes and beliefs about HPV vaccination and vaccination uptake, and some of this research has been considered in more detail in a review of the literature in Chapter 2. Not all eligible young women are taking up the opportunity to receive the vaccine. In the UK specifically, previous events such as the MMR controversy, have raised a general distrust

of vaccinations and the introduction of a newly developed vaccine, especially one relating to a sexually transmitted infection, is likely to prove contentious. Specific groups of individuals may remain unaware of, or have chosen not to, access vaccination health services based on their personal beliefs. The health psychologists' toolkit for improving the level of acceptance of cervical cancer vaccination is large. Health psychologists can use scientific methodologies and theory to identify who is less likely to receive the HPV vaccine, investigate the reasons why, and implement interventions to increase its adoption or facilitate more informed decision making. In this thesis a number of these tools have been used to help inform the wider picture of cervical cancer vaccination uptake and shall be considered in more detail in subsequent chapters.

SUMMARY OF CHAPTER 1

Cervical cancer affects over 2,000 women in England every year. Most cases of cervical cancer are caused by the highly prevalent HPV. Two vaccines have been developed to prevent infection with the two oncogenic types responsible for most cervical cancers and, along with a national cervical cancer screening programme, the HPV vaccine now forms part of the UK government's cervical cancer prevention strategy. The vaccine is most effective if received prior to infection with one of the virus types (usually equivalent to sexual debut) and as a result is now being offered to girls when they are in school-year 8. A two-year 'catch-up' programme is also making the vaccine available to all girls born after 1st September 1990 (2nd July 1990 in Northern Ireland). In the first year of the vaccination programme uptake was high in the main programme, but far fewer girls in the 'catch-up' programme received the vaccine. Health psychology research will be useful in determining personal vaccination choices and why some girls are not receiving this vaccine in particular. Such understanding will help in the design of interventions that may improve HPV vaccination uptake. Chapter 2 reviews the recent empirical literature that has explored vaccination receipt in children, focusing on the children themselves and their parents and highlights factors that are likely to affect HPV vaccination receipt in the British immunisation programme.

Chapter 2 - A literature review of factors associated with non-receipt of vaccines recommended in the UK childhood immunisation schedule and reasons that individuals give for not receiving these vaccines.

INTRODUCTION

To maximise the efficacy of HPV immunisation it is essential that uptake is high. As detailed in Chapter 1, uptake of the HPV vaccine is suboptimal in some age groups and in some countries generally. It is important to understand why this may be, and this was the main rationale for this review. Since the HPV vaccine has been developed and introduced there have been a large number of studies examining vaccination uptake under various conditions, however given the novelty of the vaccine we may also be able to use research considering other, more established early childhood vaccinations to enhance our understanding of non-receipt of vaccinations. There were three main questions that this review sought to answer:

1. What factors are associated with the non-receipt of vaccines recommended in the UK childhood immunisation schedule?

2. What factors are associated with parents'/girls' intentions to not receive the HPV vaccine?

3. What are the reasons that parents/girls give to explain why they have not received a vaccine recommended in the UK childhood immunisation schedule (intention not to receive or actual non-receipt for HPV vaccination)?

At the outset it was important to consider the definition of vaccination non-receipt. The literature uses a variety of terms to define when an individual has not received a vaccine: suboptimal compliance, incomplete immunisation, under-immunisation, not being up-to-date with vaccinations, not having received any vaccinations, delayed vaccination and not intending to receive/consent to a vaccination. Each of these terms has also been measured in a number of ways such as intention to receive a vaccine, completion of a treatment

regimen, initiation of a treatment regimen or delaying a recommended vaccine. The literature also distinguishes between unvaccinated children and under-vaccinated children. Under-vaccinated children are those who have received at least one vaccine previously, but are not fully immunised. This may be the result of deliberate non-receipt of one specific vaccine or because of practical barriers that prevent intentions to vaccinate being translated into behaviour. Generally, under-immunised children come from more socio-economically deprived backgrounds (Smith et al., 2004b). Unvaccinated children have not received any vaccinations; this may be because of total failure to engage with healthcare or an active decision by parents to not allow their child to be vaccinated at all. Unvaccinated children tend to come from more affluent, well educated families (Smith et al., 2004b). The term vaccination non-receipt is used in this review to encompass all variations on this term, but distinctions between measurement differences were highlighted where necessary.

This review considered the role that individual-level factors play in influencing vaccination, however organised resistance to, and non-receipt of, vaccinations can also be highly influential and need to be acknowledged. Organised anti-vaccination groups cannot be assumed to be representative of the opinions of parents but explorations of their stances and beliefs has helped understanding of the anti-vaccination positions that parents are exposed to. Hobson-West (2007) identified two differing anti-vaccination group orientations: reformists and radicalists. Reformist groups are often led by parents who have a personal belief that a vaccine has caused damage to their child and are more likely to be supportive of vaccination in general. Radical groups are concerned with issues such as alternative health, personal empowerment and perceptions of unreasonable power held by pharmaceutical companies. For example, vaccination non-receipt is seen by radicalists as an expression of the legal right not to vaccinate their children and is perceived as personally empowering. Anti-vaccination groups tend to be small and are often run by one or two parents, but have the potential to reach large audiences. Anti-vaccination stances have been evident since the early days of vaccination, but in the last 15 years, campaign groups opposing vaccination have again become prominent (Hobson-West, 2007).

Psychological theories relevant to vaccination decision-making

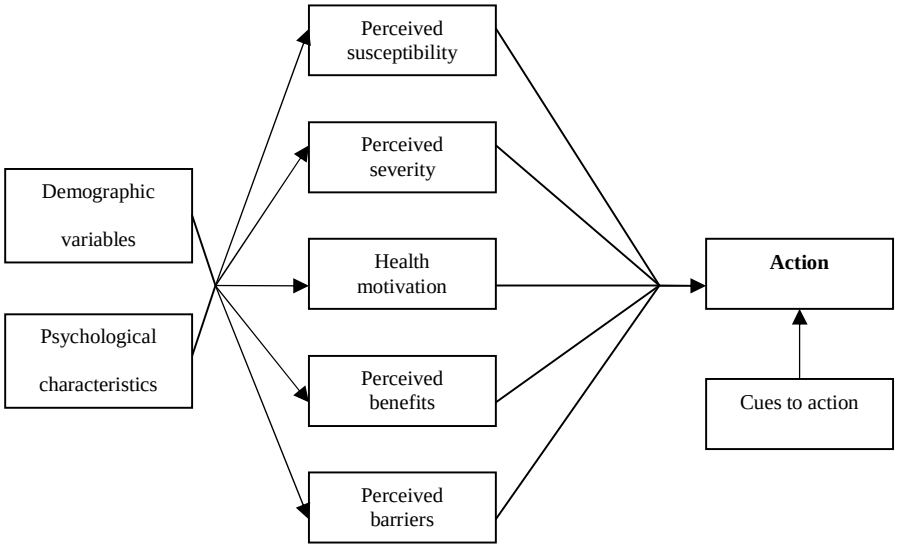
Social cognition theories of health behaviour attempt to explain why individuals choose to adopt certain health behaviours and are useful in helping to explain vaccination decision-making. They are used extensively in health psychology with many of the concepts overlapping between theories. Three prominent theories are discussed below.

The Health Belief Model (HBM, Becker et al., 1977; Rosenstock, 1966) proposes that behaviour is informed by threat perceptions and behavioural evaluations (see Figure 2.1). It is principally an expectancy-value model and was first used to explain preventative behaviour. Threat perceptions consist of perceptions of susceptibility and severity which are modified by sociodemographic factors and psychological characteristics (e.g. peer pressure). Behavioural evaluations are estimations of the benefits and barriers to engaging in a behaviour. Cues to action (triggers that inspire behaviour such as media campaigns) and the individual's motivation to be healthful also determine behaviour.

The model has been used to examine a variety of behaviours. Abraham and Sheeran (2005) grouped them into preventative health (e.g. breast self examination, Norman & Brain, 2005), sick role behaviours (e.g. insulin use in diabetic patients, Bond et al., 1992) and clinic use (e.g. preventive physician visits, Norman & Conner, 1993). Cues to action and health motivation have been understudied empirically within the model, to the extent that Harrison, Mullen and Green (1992) did not include these concepts in their meta-analysis of the utility of the HBM. Harrison et al. found significant but small correlations between the HBM components and behaviour (.15 for susceptibility, .08 for severity, .13 for benefits, -.21 for barriers). The model has been criticised for lacking specificity on how it should be operationalised, and although Becker suggested that the benefits component should be weighted against the barriers component, a formula describing how this should occur has not been developed (Abraham & Sheeran, 2005). This has resulted in researchers using different interpretations of the model (a validated questionnaire does not exit) which has weakened its evidence base and the coherence and consistency of the model (Harrison et al., 1992). The model also ignores social, cultural and emotional aspects of behaviour decisions. In an attempt to update the model and improve its predictive utility, Rosenstock

et al. (1988) added 'self-efficacy', but again did not specify how it interacted with beliefs. Research has suggested that beliefs may indirectly affect self-efficacy which may then determine action (Schwarzer, 1992).

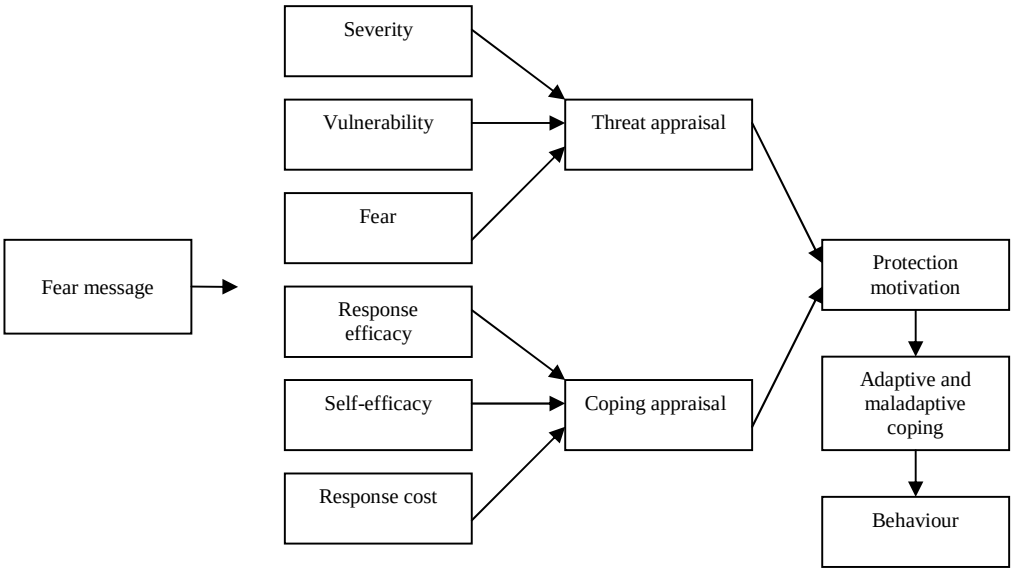
Figure 2.1 - Health Belief Model. Adapted from Abraham and Sheeran (2005)



Protection Motivation Theory (PMT, Figure 2.2) was first developed by Rogers (1975; 1983). It attempts to explain individuals' behavioural responses to fear messages. The theory proposes that individuals appraise both the threat and the coping method available to them to deal with the threat. These appraisals inform intentions (protection motivation) which directly affect behaviour. Threat evaluations consider the individual's perceived vulnerability to the threat, how severe they believe the threat is, and the level of fear aroused by the threat. Coping evaluations take into account how effective the individual believes the response to be (response efficacy), their belief in their ability to engage in that response and their perceived costs of the response. The theory has been used widely to explain behaviours, with two recent examples being exercise in coronary artery disease patients (Tulloch et al., 2009) and sun protective behaviours (Prentice-Dunn et al., 2009).

Milne, Sheeran and Orbell (2000) in their meta-analysis of studies that have used PMT found the theory to modestly predict behaviour. Intentions to engage in a behaviour were correlated with threat and coping appraisals (vulnerability=.16, severity=.10, fear=.20, self-efficacy=.33, response efficacy=.29 and response costs=-.34). The model showed generally weaker associations with current behaviour (vulnerability=.13, severity=.10, fear=.26, self-efficacy=.36, response efficacy=.17, response costs=-.32 and intention=.82) and was even less predictive of future behaviour (vulnerability=.12, severity=.07, fear=-.04, self-efficacy=.22, response efficacy=.09, response costs=-.25 and intention=.40), although these correlations are on the whole higher than those reported for the HBM. Coping appraisals had a greater predictive ability than threat appraisals. Although the model has received some empirical support, some researchers have suggested that threat appraisals are only influential when the subject is novel to the individual and others have questioned the stability of the constructs over time (Boer & Seydel, 1995), although this is likely to be a criticism of all social cognition model constructs.

Figure 2.2 - Protection Motivation Theory adapted from Boer and Seydel (1995)

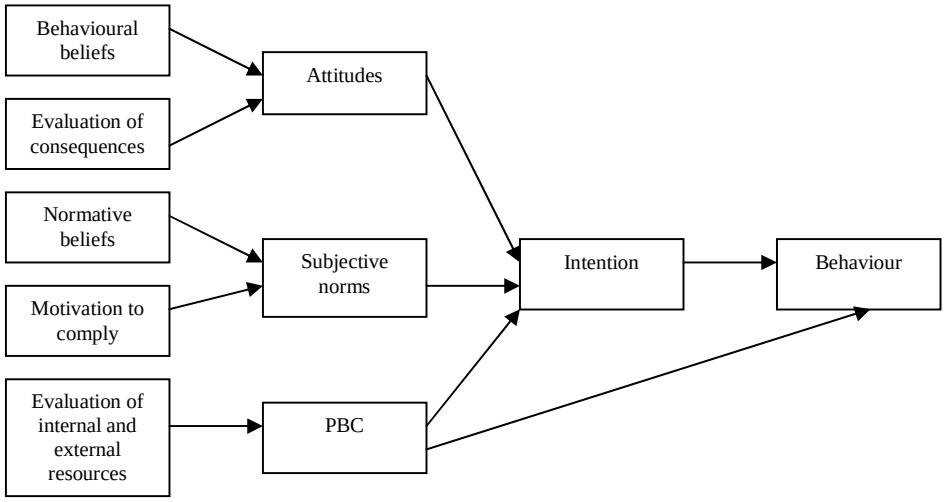


The Theory of Planned Behaviour (TPB, Ajzen, 1985; Ajzen, 1988; Ajzen, 1991), an extension of the Theory of Reasoned Action (TRA, Ajzen & Fishbein, 1980; Fishbein & Ajzen, 1975), was also developed as an attempt to predict behaviour (Figure 2.3). The model proposes that intentions are the most proximal determinants of behaviour. Intentions are themselves informed by salient attitudes (beliefs about the behaviour), subjective norms and perceived behavioural control (PBC, how much control the individual believes they have over enacting the behaviour). PBC is similar to Bandura's construct of self-efficacy (1982) and is itself also a direct determinant of behaviour. These three determinants of intention each are influenced by additional constructs. Attitudes are informed by behavioural beliefs (belief that performing the behaviour could lead to some consequence) and evaluations of the consequences. Subjective norms are determined by normative beliefs (whether the individual believes that significant others would want them to adopt the behaviour multiplied by their motivation to comply with this individual's beliefs). PBC is determined by the individual's evaluation of their external and internal resources, for example opportunities and skills. Other determinants of behaviour such as demographics affect behaviour through the TPB components. Since its development, researchers have suggested adding a number of different constructs to the model, such as anticipated regret (Richard & van der Pligt, 1991), self-identity (Sparks & Shepherd, 1992), moral norms (Sparks, 1994) or past behaviour (Bentler & Speckart, 1979). Researchers have also replaced intentions with self-predictions in some studies (Sheppard et al., 1988), while others have suggested that attitudes inform desires which then determine intention (Bagozzi, 1992).

The model has been used widely to predict behaviour, such as studies investigating condom use (Gredig et al., 2007), pain relief use during childbirth (Williams et al., 2008) and smoking cessation (Rise et al., 2008). Armitage and Conner's meta-analysis of studies that have used the TPB found the model to account for 27% of variance in behaviour and 39% of variance in intention (Armitage & Conner, 2001). Correlations between the constructs ranged from .34 (subjective norm-intention) to .63 (combination of attitude, subjective norm and PBC on intention). The strongest individual correlation was for control beliefs informing PBC (.52). Subjective norm was found to be the weakest construct but the authors suggest that this was due to poor measurement. The model was most accurate

when behaviour was measured objectively. Finally the theory has been criticised as the ordering of beliefs and the direction of causality is not specified (Schwarzer, 1992).

Figure 2.3 - Theory of Planned Behaviour adapted from Conner and Sparks (1995)



Rarely has research compared the efficacy of the models in explaining behaviour. Bish et al. (2000) found both the TPB and HBM to be equally poor in predicting future cervical screening attendance, however the TPB was superior in predicting behavioural intentions. The model-specific meta-analyses reported in this section suggest that the TPB and PMT are more strongly associated with behaviour and behavioural intentions than the HBM. The HBM is likely to be the weakest of the three social cognition models, although comparisons between meta-analyses are purely descriptive.

Social cognition models such as the ones described above have been criticised for assuming that behavioural decision making is rational and logical, however the concepts are useful to help understand behaviour. The theoretical concepts from these models were used in this review to draw together some of the factors identified to be important in determining vaccination non-receipt to see how the factors fit with theories of health psychology and the pathways of association that they propose.

This systematic review of the literature was designed to answer the three research questions outlined at the beginning of this chapter:

1 What factors are associated with the non-receipt of vaccines recommended in the UK childhood immunisation schedule?

2 What factors are associated with parents'/girls' intentions to not receive the HPV vaccine?

3 What are the reasons that parents/girls give to explain why they have not received a vaccine recommended in the UK childhood immunisation schedule (intention not to receive or actual non-receipt for HPV vaccination)?

METHOD

This systematic review followed the Cochrane guidelines for conducting systematic reviews (Higgins & Green, 2009).

Inclusion criteria (Table 2.1)

Falagas & Zarkadoulia (2008) published a systematic review of factors associated with suboptimal compliance of childhood immunisations in developed countries. This review sought to add to their findings (which will be discussed) by including all articles published after 31st January 2005 (Falagas et al.'s last search date). Articles were included if they statistically examined the factors associated with non-receipt of vaccinations that are currently part of the UK childhood immunisation schedule[4] in children/adolescents (for review question 1 and 2) or reported the reasons for non-receipt of vaccinations currently part of the childhood immunisation schedule in children/adolescents (for review question 3). Although the vaccines of interest were ones included in the UK schedule, studies were included if they were conducted outside of the UK if they focused on these vaccines. Articles were included if their participants were parents of children under the age of 18 (or

[4] DTaP/IPV/Hib (diphtheria, tetanus, acellular pertussis/inactivated polio vaccine/Haemophilus influenzae type b), PCV (pneumococcal cojugate), MenC (meningitis C), MMR (measles, mumps and rubella), HPV (human papillomavirus).

parents of daughters under the age of 18 for HPV) or children/adolescents under the age of 18 (or girls under the age of 18 for HPV). Articles were included if some of their participants were outside of these inclusion criteria so long as the desired participants were also in the sample. For example a sample may have examined girls and women up to the age of 26 or HPV vaccine analysis may have used parents of sons and daughters, or some of the sample may have responded about a hypothetical child. Legal guardians were considered to be parents. Articles that examined intentions not to receive vaccinations were excluded apart from those that considered HPV vaccination[5]. Papers reporting the findings of qualitative studies must have detailed the reasons for vaccination non-receipt in participants who had previously not received the vaccine (or intended not to for HPV vaccination). Articles were excluded if they were not published in English, not published in peer review journals, were conference abstracts or editorials, if the participants had underlying health conditions, if they only reported the results of an intervention aimed to reduce vaccination non-receipt or studies that were conducted in developing countries. Reviews were also excluded from the main review but were discussed at the end of this review.

This review only reported the univariate findings of the included studies as its aim was to solely identify the factors that have been shown to be associated with vaccination non-receipt. Multi-variable analyses were defined as those analyses that had included more than one independent variable in the statistical model at the same time. In these models the statistical results would have been adjusted for all independent variables that were in the model. Studies that employed multiple-variable tests will each have adjusted for different factors making comparisons between studies difficult, impossible or unhelpful. Theories of social cognition from health psychology may be useful to help illustrate the pathways through which the factors identified in this review work to affect vaccination non-receipt and they shall be used in the discussion section for this purpose.

[5] As HPV vaccination has only recently become available much of the research in this area has only considered intentions not to receive the vaccine. It is established that intentions do not always reflect behaviour (Sheeran, 2002) and so their use in predicting vaccination non-receipt is not optimal. Intentions were not assessed for more established vaccines in the childhood immunisation schedule as they have been available for a sufficient length of time for research to consider actual vaccination non-receipt.

Table 2.1: Inclusion and exclusion criteria

	Inclusion criteria	*Exclusion criteria*
Focus	Statistical associations with non-receipt of a vaccine in the UK childhood immunisation schedule or reported reasons for not receiving a vaccine in the childhood immunisation schedule.	Reported an evaluation of an intervention only. *For qualitative studies:* Parents who have not refused vaccination/intend to refuse the HPV vaccination
Outcome	Actual vaccination non-receipt Intention to refuse the HPV vaccine Reasons given for actual vaccination non-receipt or intention to refuse the HPV vaccine	Intention to receive any vaccine (other than HPV) Only reported multi-variable analysis
Article type	Primary research article in peer reviewed journals.	Editorial, review, conference abstract
Participants	Conducted in developed countries *For all childhood vaccines:* Parents of children under the age of 18 Children under the age of 18 *For HPV vaccine:* Parents of daughters under the age of 18 Girls under the age of 18	Children sampled primarily because of an underlying health condition *For HPV vaccine:* Parents of sons only Only parents of daughters who are over the age of 18 or their age not reported.

Search strategy

The following databases were searched for this review: Embase, Medline, Web of Knowledge, Cumulative Index to Nursing and Allied Health Literature, Psyc Info, Cochrane Database of Systematic Reviews (CDSR) and Health Management Information Consortium. Following a basic search using key words from the review questions, five categories of terms were chosen to be used in the database searches based on the MeSH terms from the articles retrieved. These categories were broadly: 1) intention or patient acceptance of health care, 2) adolescence or infancy, 3) immunisation, 4) demographics and 5) predictors. The terms in these categories were adapted to meet the unique thesaurus or subject headings for each database and truncations and wildcards used (see Appendix 1 for the detailed search terms used). The search was pre-tested and refined to ensure that relevant articles were retrieved. The search was restricted to articles published post-January 2005 and yielded 989 articles. The reference lists of the reviews identified in the main search were also searched to identify any articles that should also have been included; this yielded 47 extra articles. The last search was conducted on 17th May 2010. See Table 2.2 for the number of articles excluded and the reasons for exclusion and Appendix 1 for

the number of articles downloaded from each database and Appendix 2 for a reference list of the final articles included in the review.

Table 2.2: Number of articles excluded and reasons for exclusion.

Reason for exclusion	Frequency (original N=989)
Did not examine the predictors of vaccination acceptance/off-topic	274
Did not examine parents who have decided against vaccination	1
Was an evaluation of an intervention	7
Examined a vaccine that is not in the UK childhood immunisation schedule	250
Examined intentions to refuse a vaccine (not HPV)	3
Was not peer reviewed	9
Did not examine parents/girls as participants	56
Was not conducted in a developed country	125
Sample participants primarily because of an underlying health condition	13
Qualitative study not looking at those who have refused a vaccine (or intend to)	3
Duplicate	154
Published pre-2005	22
Reported data repeated from another article included in the review	1
Review/editorial that considered <3 studies	8
Paper arising from data in this thesis	2
Reported multi-variable findings only	9
Not enough information provided to locate the article	1

Data extraction

A standardised data extraction form was used to extract the information for review (see Appendix 3 for an example of a completed data extraction form). Each article was given a unique ID number. The author, title, year of publication was extracted. In the methods section, the following information was extracted: definition of non-receipt, vaccine of interest, whether the study was powered to detect a small, medium or large effect size, whether the study was prospective, whether validated measures were used, the measurement of vaccination non-receipt and intention, whether piloting occurred and how qualitative data were analysed. Information about the participants that was extracted included: the child's gender, average age of the child, who the respondent was, sample size, recruitment site, response rate, country of study. From the results, I extracted the average socioeconomic status of the sample, the most common ethnicity, the factors that were considered to be associated with non-receipt, univariate findings, non-significant findings and qualitative findings.

Assessing the methodological quality within studies

Methodological limitations allow bias to be introduced into results. The greater the bias the less confident we can be that the results are accurate and could be replicated. By assessing the quality of the methodology of studies included in reviews we can judge whether our conclusions are likely to reliable and we can place greater weight on the findings of studies that are considered to be methodologically stronger in informing our conclusions. A number of tools are available to aid assessment of methodological quality, for example Scottish Intercollegiate Guidelines Network, SIGN; Oxford Centre for Evidence-Based Medicine, OCEBM; the National Service Framework, NSF, and US Preventive Services Task Force (Atkins et al., 2001; Ball et al., 2009; Petrie et al., 1995; Turner-Stokes et al., 2006). The NSF tool is recommended for psychometric studies (NHS Plus & The Clinical Effectiveness Forum, 2009), but it was deemed not to be rigorous enough for the present review. Atkins et al. (2004) note that no tool is appropriate for use with every target group and every review will value certain methodological aspects more than others. As a result, guidelines recommended by the Cochrane Handbook for Systematic Reviews of Interventions (Higgins & Green, 2009) and existing quality assessment tools including the NSF, were adapted and used for this review based on informed judgment. For this review, methodological quality was assessed by taking into consideration the quality of six aspects of study methodology: study design, response rate, study power (for quantitative studies), piloting, how the outcome was measured and the quality of qualitative analysis conducted (for qualitative studies).

- Study design: For this review prospective studies were considered the most appropriate choice for considering the predictors of vaccination acceptance. Prospective studies are more informative about causation. Furthermore recall bias is likely to hinder the reliability of retrospective studies. A score of 1 for methodological quality was assigned to prospective studies and 0 for all other designs.

- Response rate: Low response rates provide more opportunity for the introduction of bias as non-responders may differ from responders. If a large proportion of a population is not included in a study we cannot be certain that the results are generalisable to that population or to similar populations. Response rates greater than 50% were assigned a score of 1 and those below 50% scored 0. Studies that used all patient records from a

particular population (and so response rates were not applicable) were also given a score of 1.

- Power: In order for studies to be able to detect significant differences between groups they must be powered sufficiently. The level of power that was considered appropriate for the types of studies in this review was determined by looking at the effect sizes reported by a selection of studies used in Falagas and Zarkadoulia's (2008) review. Effect sizes in these studies were often small, especially for attitudinal variables, it was likely that this would be the case for studies in the present review. Assuming 80% power and an alpha of .05, 395 participants would be needed to detect a small effect size, 55 participants needed to detect a medium effect size and 25 participants needed to detect a large effect size. As a consequence, studies with >395 participants were given a score of 1 and studies not powered to detect small effect sizes scored 0. The total sample size reported was used when assessing power, rather than sample size reported for the different tests as sample sizes varied between statistical tests in the same article.

- Piloting: Piloting ensures that a study is as methodologically strong as is possible and helps ensure that the results represent what researchers intended to investigate. Studies that piloted their methodology prior to the main study were assigned a score of 1, and those that did not were given a score of 0.

- Measurement of the outcome: Investigations of vaccination acceptance tend to use either self-report or review of medical records (Falagas & Zarkadoulia, 2008). Self-report is subject to recall bias and often requires individuals to remember which vaccinations were received years previously. There are a number of vaccinations in the childhood immunisation schedule, making parent recall even more difficult. Medical records, although not perfect (Harrington et al., 1995; Jefferies et al., 1991; Salmon et al., 2005; Wei et al., 2009), are documented statements of vaccination receipt made at the time of vaccination and are likely to be more accurate, and therefore introduce less error into the results. Studies using objective measures of vaccination receipt were given a score of 1 and studies using self-reported measures were given a score of 0. For studies in which intention to vaccinate was the outcome, studies that reported an intention measure that was judged appropriate were given a score of 1. Studies that did not report the intention measure used or that used a measure that was considered inappropriate were given a score of 0.

Inappropriate intention measures were ones which were not specific enough to ensure that measurement did not contain a high degree of error.

- Quality of the qualitative analysis: qualitative analysis is inherently subjective, but techniques can be employed to improve the methodological rigour and ensure that interpretations are warranted. Such techniques include using multiple raters to analyse the data (and reporting concordance between raters), using a coding frame to ensure consistency throughout analysis, and using a formal analytic method (such as discourse or framework analysis). Studies that had employed such techniques were given a score of 1 and all others were given a score of 0.

Study quality was determined by summing the quality scores and categorised using definitions recommended by the Cochrane Handbook for Systematic Reviews of Interventions (Higgins & Green, 2009):

- High: All or most of the quality indicators were met, and if they were not, the conclusions of the study were thought very unlikely to alter (score of 4 or 5). Methodologically strong.

- **Moderate**: Some of the quality indicators were met and where they were not, or were not adequately described, the conclusions of the study were thought unlikely to alter (score of 2 or 3). Methodologically strong in some areas.

- Low: Few or none of the study indicators were met, or were not adequately described and the conclusions of the study were thought likely or very likely to alter (score of 0 or 1). Methodologically weak.

Reporting and interpretation of findings

This review did not take into account results when the direction of findings or the details of findings were not reported. Often studies grouped all early childhood vaccinations together (DTaP/IPV/Hib, PCV, MenC, MMR) for this reason these vaccinations were grouped together for the purpose of this review, unless an individual vaccine was specified. HPV was not included in this group as it was the main focus of this thesis. The ID number for each study that considered each factor was provided in brackets in the results section. In

the tables, the study ID number has been formatted according to the quality of that study: underlining indicates high quality, **bold** indicates medium quality and no formatting denotes low study quality. Assessments of the methodological quality within studies were used in part to draw conclusions about the strength of the evidence across studies. The following interpretations were made following the approach and definitions used by the Cochrane handbook (Higgins & Green, 2009):

- Low risk of bias: Most information is from studies at low risk of bias (high quality). Plausible bias unlikely to seriously alter the results.
- Unclear risk of bias: Most information is from studies at low or unclear risk of bias (moderate quality). Plausible bias that raises some doubt about the results.
- High risk of bias: The proportion of information from studies at high risk of bias is sufficient to affect the interpretation of results (low quality). Plausible bias that seriously weakens confidence in the results.

RESULTS

The results were discussed by each review question separately, followed by a discussion of existing reviews of the literature.

Description of the studies

In total 88, empirical studies were included in this review (n=64 for review question 1, n=36 for review question 2, n=33 for review question 3) and there were 10 existing reviews. A minority of studies reported both qualitative and quantitative findings. Of the studies considered for review question 1, 39 explored vaccination receipt, 16 looked at vaccination completion and nine examined delayed vaccination; a minority of studies considered more than one definition of vaccination non-receipt or actual non-receipt and intentions. HPV vaccination was the vaccine of interest in 56 studies, other childhood vaccinations were considered in 32 studies and one study examined both types of vaccines. Most of the studies were of medium quality (n=54 quantitative studies and n=22 qualitative studies); there were a small number of low quality studies (n=13 quantitative studies and n=11 qualitative studies) and even fewer high quality studies (n=5 quantitative studies and

n=0 qualitative studies). Studies were performed in 17 countries; the majority came from the USA (n=50), 19 were conducted in the UK, three in Italy, two from Australia and The Netherlands, and a single study was performed in the remaining countries (Belgium, Canada, Denmark, Finland, Germany, Greece, Israel, Japan, Spain, Sweden, Switzerland and New Zealand).

Participants were recruited from schools, medical centres (either in person or their medical records used), national samples (whole year cohorts and random samples), community centres and from previous studies and nurseries. Snowballing sampling was also used for qualitative studies. Vaccination receipt was measured by self-report in most cases but some studies used objective measures such as medical records and others validated a proportion of self-reported vaccination statuses using medical records.

Description of the populations studied

Often an age range for the target child was provided rather than a mean age. The mean for these age ranges was taken, and along with studies that provided an actual mean age, the mode age was calculated. The most common age of the target child was 11 years. Varying measures of family socio-economic status (SES) were used. For measures of highest level of parental education the most common academic achievement was a high school education or greater (n=12), for measures of wealth the most common outcome was being privately insured for healthcare (n=3). Often a range of incomes were provided when reporting SES, making it difficult to estimate the most common income, a crude estimate was that most participants earned over $50,000 per year. In around one third of cases, ethnicity was not reported (n=32) and in over half of the studies that did report ethnicity the most common ethnic group was white (n=35). Most studies were conducted with mothers and fathers (n=45). Twenty-one studies investigated the child/adolescent themselves and 23 studies looked at just mothers. A number of studies looked at both adolescents/children and parents and no study investigated fathers only.

Review question 1: What factors are associated with the non-receipt of vaccines recommended in the UK childhood immunisation schedule?

Demographic characteristics (Table 2.3)

Associations between ethnicity and receipt of both childhood vaccines and HPV were considered in 21 studies conducted in a number of countries, with 16 reporting significant findings. Minority groups were most likely to have refused vaccinations in some studies (8, 102, 26, 37, 32, 54, 63, 86, 107, 63, 106; see Appendix 2 for reference list of included articles) but not all (12, 30, 92, 42, 78), and most were of medium quality indicating an unclear risk of bias for the overall finding. There was an unclear risk of bias for the six non-significant studies (42, 45, 59, 75, 87, 93). This evidence suggests that ethnic minority groups are possibly more likely to have refused vaccination.

Various forms of SES were considered including income, postcode level data and attendance at a state versus public school in 16 studies. Positive, negative and non-significant relationships were found for both childhood vaccines and HPV specifically; all of these relationships had an unclear risk of bias. Three studies found less deprived participants to be more likely to be unvaccinated (26, 30, 102), eight medium quality studies found more deprived participants to be more likely to be unvaccinated (8, 12, 22, 26, 47, 63, 102, 113) and five studies reported non-significant findings (54, 87, 92, 93, 105). The evidence for SES is unclear.

Table 2.3: Demographic findings for research question 1 (n=low quality, **n**=medium quality and n=high quality)

Factor (if yes/no, yes=high)	Positive association (high factor = more likely unvaccinated)	Negative association (low factor = more likely unvaccinated)	Direction cannot be assigned	Non-significant result
Ethnicity			Ethnic minority school: **8, 102**; non-Hispanic: **12, 30**, 92**;** non-white: 26, **37, 47**; Maori/New Zealand European: **32;** Do not live in Northern Ireland: 42; Moroccan: **54;** Black: **63, 86, 107;** Asian: **63;** Unknown/other ethnicity: **63;** Hispanic: **63, 86;** not Black: **78,** ethnic minority: **106**	42, **45, 59, 75,** 87, **93**
SES	**26, 30, 102**	**8, 12, 22, 26**, **47, 63, 102, 113**		**54**, 87, 92, **93, 105**
Education	**26,** 42, **46, 103**	**12, 31, 45, 47, 62, 63, 106, 113**		**36, 59, 62**, 92, **93, 105**
Child age	**62, 63, 89**	**12,** 73, **75, 78, 79, 93, 108**		**45, 54, 78, 84, 86, 93**
Parent age	**12, 26,** 42, **46, 62**	28, 42, **47, 105, 106**		**10,** 42, **36, 45, 59,** 92, **93, 103, 106**
Was child the first born?		**10, 36, 44, 47**		**26**
Religion				92, **103**
Marital status			Not married: **26;** Single parent: **31**, 42, **62**	92, **93**
Parents' employment			Mother returned to work within 12 weeks of birth: 6; Mother working: **36;** Mother self-employed: 42; Mother unemployed: 42, Parents not employed: **93**	
Child's gender			Male: 42; Female: **62**	**26, 31, 37, 44, 54, 106, 108**
Parents' gender			Mother: **107**	**75, 93**
No. children in family	**103, 106, 113**			**26, 59, 93**
Family make-up			Traditional family set-up: **103**	**45**
Native speaker of country?		**31, 93**		42
Native to the country of study?		**54, 106**		**62,** 92, **103**
Region of residence			Live in rural location: **113, 93**	**75,** 87, **93, 106**
Relationship of guardian to child				92

The evidence was similarly unclear for degree of education, child's age and parent's age. For degree of education, the evidence had an unclear risk of bias and positive (26, 42, 46, 103), negative (12, 31, 45, 47, 62, 63, 106, 113) and non-significant (36, 59, 62, 92, 93, 105) results were reported for studies conducted in numerous countries that considered childhood vaccinations and HPV vaccination. Child's age showed positive (62, 63, 89), negative (12, 73, 75, 78, 79, 93, 108) and non-significant (45, 54, 78, 84, 86, 93) associations with vaccination non-receipt and all of these relationships had an unclear risk of bias. These studies considered both HPV and childhood vaccinations generally, and were mainly conducted in the USA. Evidence for parent's age had an unclear risk of bias, considered both childhood vaccines and HPV vaccination and studies were conducted in a number of countries. Positive (12, 26, 42, 46, 62, 62), negative (28, 42, 47, 105, 106) and non-significant (36, 45, 59, 92, 93, 103, 106, 10, 42) associations were reported between parents' age and vaccination non-receipt. Religion was not associated with vaccination non-receipt in two studies (92, 103; n=1 medium quality and n=1 low quality).

Children who were not the first born in their family appeared to be more likely to be unvaccinated for childhood vaccinations (10, 36, 44, 47, all medium quality studies), although one non-significant finding was reported (26). Parental employment in most studies was shown to be associated with non-receipt of childhood vaccinations (6, 36, 42), but parental unemployment was only associated with HPV vaccination non-receipt in one study of medium quality (93); the level of bias for these findings was unclear. Being an unmarried or single parent appeared to be associated with non-receipt of childhood vaccinations (26, 31, 42, 62), although there was an unclear risk of bias for this finding. Marital status was not associated with HPV vaccination receipt in two American studies of medium and low quality (92, 93).

The evidence suggested no role for the child's gender as the majority of studies showed no associations between child's gender and childhood vaccination non-receipt (26, 31, 37, 44, 54, 106, 108) and this had an unclear risk of bias. One study of high quality found males to be more likely to be unvaccinated (42) and one study of medium quality reported the opposite (62). One medium quality study found the gender of the parent to be associated

with receipt of childhood vaccines (107) and two medium quality studies found the gender of the parent to not be associated with receipt of the HPV vaccine (75, 93), suggesting that the evidence for the role of parents' gender is uncertain. One American study (low study quality) did not find there to be an association between the relationship of the primary caregiver to the target child (e.g. foster mother, grandmother) and HPV vaccination receipt (92). One Canadian HPV vaccination study (medium quality) found children from traditional family set-ups to be more likely to be unvaccinated (103), but another study (45, medium quality) found family cohesion not to be related to receipt.

Three medium quality studies showed a positive relationship between number of children in the household and likelihood of childhood vaccine and HPV vaccine non-receipt (103, 106, 113), although three medium quality studies found no association for childhood vaccination (26, 59, 93), meaning that the evidence for this factor is uncertain. The significant studies were conducted in Canada, Belgium and Greece, whereas the non-significant studies were performed in the UK and USA, although this does not provide a clear explanation for the difference in findings.

Participants who spoke a language that was not the official language of the country where they lived were at an increased likelihood of not receiving either the HPV vaccine or childhood vaccines in two studies of medium quality (31, 93), but not in one high quality British study exploring MMR vaccination receipt (42). Not being born in the country that the study was conducted in was also shown to increase the likelihood that childhood vaccines were not received in two medium quality studies (54, 106) but not in three studies (n=1 low quality) exploring both childhood vaccines and HPV vaccine receipt (62, 92, 103). The evidence for the role of country of origin and mother tongue was unclear.

Two medium quality studies investigating childhood vaccines and the HPV vaccine found that participants who lived in rural locations were less likely to be vaccinated (113, 93) but four studies similarly of unclear bias found non-significant results (75, 87, 93, 106), meaning that definite conclusions cannot be drawn.

Summary of demographic findings

All the findings for demographic characteristics were of medium quality had an unclear risk of bias and no factor had an indisputable relationship with vaccination non-receipt. The findings were more conclusive for childhood vaccinations than for HPV vaccination. Some evidence suggested that minority ethnic groups may be at a greater risk of being unvaccinated with all vaccines, as are children with unmarried or single parents (although not for HPV vaccination). Children of employed parents may be less likely to receive childhood vaccinations as may non-first born children. It is likely that there is no relationship between the gender of a child and their vaccination status for childhood vaccinations.

Practical factors (Table 2.4)

Four studies reported significant findings concerning the type of clinic that a child was recruited from and had an unclear risk of bias (3, 12, 46, 113); however there was no consistency in the definitions used to describe each clinic, or in which clinic vaccination non-receipt was highest. There is likely to be a relationship between clinic type and vaccination status but more research is needed.

Need for more information showed positive relationships with non-receipt of childhood and HPV vaccination in these studies (23, 65, 106), but and also negative (10, 23) and non-significant relationships (23, 106) for childhood vaccines. All of these findings had an unclear or plausible risk of bias and the evidence for the role of this factor is unclear. Two studies have considered the amount of information sought and its association with HPV vaccinations and childhood vaccinations. Both found that children were more likely to be unvaccinated if more information had been sought (46, 74, n=1 of low quality and n=1 of medium quality).

Table 2.4: Practical factors for research question 1 (n=low quality, **n**=medium quality and n=high quality)

Factor (if yes/no, yes=high)	Positive association (high factor = more likely unvaccinated)	Negative association (low factor = more likely unvaccinated)	Direction cannot be assigned	Non-significant result
Clinic type			Non-school-based clinic: **3;** Not paediatrician: **12**; non-physician **46;** nurse: **46;** CAM: **46,** vaccination-only clinic, non-well-baby clinic: **113**	
Need more information about vaccine?	23, **65, 106**	**10,** 23		23, **106**
Format of the information	**46,** 74	**46, 47, 79,** 87		23, **46**
Usefulness of information gained		**46, 47,** 74, **79**		**46,** 74, **79**
Amount of information sought	**46,** 74			
Length of time registered at clinic		**12**		
Easy access to the clinic?		**106, 108**		**87,** 92, **93**
Child unwell?	**47, 78, 86**			**36**
Health insurance status			Having public health insurance: **37; 86**. Not being insured: **37, 89, 105;** Not private health insurance: **47, 78;** do not believe vaccine is covered under insurance: **75;** Not having public insurance: **78**	**63, 93, 106**
Was there a vaccine shortage?	**37**			
Vaccination experience			**106:** Unfriendly staff	**89**

Six studies considered the format of the information that participants reported using. Often only one study considered each format and on no occasion did two studies explore the same format and report the same finding, meaning that the evidence is uncertain. The studies were all of medium or low quality indicating that in addition to the weak evidence the risk of bias was unclear or plausible. Children were found to be more likely not to have received childhood vaccines or the HPV vaccine if their parents gained information from professional organisations, pharmaceutical companies, charities, religious leaders, friends/family, the internet, information evenings, government or the media (46, 74). Children were also more likely to be unvaccinated if their parents had not used the media for information, as well as if they had used healthcare professionals, leaflets or their child's school (46, 47, 79, 87). Finally non-significant results were reported for whether a parent had used the government for information, healthcare professionals or pharmacists (46, 23).

Four studies explored the usefulness of the vaccine information used by participants and its association with HPV vaccines and childhood vaccines. Negative and non-significant findings were reported, suggesting that parents who find information useful are unlikely to refuse vaccination. Participants who perceived the information gained from information sheets, pharmaceutical companies, charities, professional organisations, the government or healthcare professionals to be less useful were more likely to have children who were not vaccinated (74, 79, 46, 47). Non-significant effects were also reported for information sheets, as well as for the usefulness of the media, religious leaders and friends/family (46, 74). Again, each information format was considered once by one study meaning that definite conclusions cannot be made.

One medium quality HPV vaccination study conducted in the USA reported that adolescents who had been registered at the study clinic for a short period of time were more likely to be unvaccinated than those who had been registered for a longer period of time (12). One study examined the impact of a vaccination shortage on childhood vaccination receipt and reported both non-significant and significant findings (37). Two medium quality studies considering childhood vaccines found participants to have not received the vaccine if they did not have easy access to a vaccination clinic (106, 108), but three studies

reported non-significant findings (one of low quality, two of medium quality, 87, 92, 93). This evidence suggests that parents who have easy access to clinics are unlikely to have not accepted a vaccine for their child, but the evidence is unclear when access is more problematic.

The health of the child at the time of vaccination was considered in four studies, including the reason that the child was attending the clinic and the child having allergies. Three American studies, all of medium quality, found poor health to be related to non-receipt of childhood and HPV vaccines (47, 78, 86) but one medium quality Japanese study found no relationship for measles vaccination (36). This evidence suggests a potential role for poor health. Past vaccination experience including pain at last vaccination and perceiving vaccination staff to be unfriendly were found to be both associated (106) and not associated (89) with childhood and HPV vaccination receipt in two medium quality studies, limiting conclusions from being drawn.

Not having health insurance (or being unsure of health insurance status) increased the risk of being unvaccinated for childhood and HPV vaccines in seven studies and this finding had an unclear risk of bias (37, 86, 89, 105, 47, 78, 75). Three medium quality studies reported non-significant findings for health insurance (63, 93, 106). The evidence suggests that those without health insurance are probably more likely to have not received a vaccine.

Summary of practical factor findings

No high quality study considered relationships between practical factors and vaccination non-receipt. No one factor showed a conclusive relationship with vaccination non-receipt and all findings had an unclear risk of bias. A number of factors were only considered in a few studies. Clinic type does appear to relate to vaccination receipt but a lack of consistency in defining clinic types means that this finding cannot be expanded. There is a potential relationship between a need for more information and HPV vaccination, although weak evidence suggests that children are more likely to be unvaccinated if more information has been sought. It is possible that a child with sub-optimal health at the time

of a clinic visit may be more likely to remain unvaccinated. Finally, children without or perceived to be without health insurance are more likely to have not received a vaccine.

Lifestyle choices, past behaviour and past health outcomes (Table 2.5)

There is consistent evidence that parents who choose more 'alternative lifestyles' (use complementary and alternative medicine or send their child to an anthroposophic school for example) are more likely to have children who are unvaccinated with childhood vaccines (10, 46, 54, 62), although the risk of bias for this finding was unclear. Positive (36), negative (108) and non-significant associations (31) have been found between whether a child went to nursery school and childhood vaccination receipt. Consequently, the evidence for this factor is uncertain and all of the studies were of unclear risk of bias. The majority of the evidence suggests that children who have not previously received recommended vaccines or who have ever had a vaccine deferred are less likely to have received HPV vaccination and other childhood vaccines (10, 37, 43, 62, 93, 102, 103), although four non-significant findings were reported (n=1 of low quality, n=3 of medium quality). The risk of bias for these findings was unclear. Mothers who are smokers have been shown to be more likely to have children who have not received the MMR vaccine (42, high quality study), although non-significant findings were reported in one low quality study examining HPV vaccination and smoking (87). More high quality evidence is needed before definitive conclusions can be made about the role of smoking. One low quality HPV vaccination study found children whose parents had not spoken to others about the vaccine were more likely to be unvaccinated (73) but one medium quality study reported non-significant associations for MMR vaccination (10); again more research is needed here. Children who have fewer clinic visits appear to be less likely to receive childhood and HPV vaccines in the USA (37, 47, 87, 92, 109) although this finding has an unclear risk of bias.

Table 2.5: Lifestyle choices, past behaviour and past health outcome (n=low quality, **n**=medium quality and n=high quality)

Factor (if yes/no, yes=high)	Positive association (high factor = more likely unvaccinated)	Negative association (low factor = more likely unvaccinated)	Non-significant result
Age that mother had her first child	**62**		**10,** 42
Child went to nursery?	**36**	**108**	**31**
Have an alternative lifestyle?	**10, 46, 54, 62**		
Received previous vaccines?		**10, 37, 43, 62, 93, 102, 103**	**62,** 92, **93, 105**
Is respondent a smoker?	42		87
Have spoken to others about the vaccine?		73	**10**
Number of clinic visits		**37, 47,** 87, **92, 109**	
History of cervical screening?		**12**	**86,** 87, 92, **93**
History of abnormal cervical screening?	**89**	**12**	**45,** 87, **89, 103**
History of STI?		**12, 45**	**75, 12, 89**
Experience of cancer?			**75,** 92, **93, 103**
Child has boyfriend/girlfriend?			**45**
Number of sexual partners			**89**
Age of first sex			**45, 89**
Have ever had sex?			**86**
Ever pregnant?	**89**		**93**
Use condoms?	**89**		
Political stance			92, **45**
Talk to child about sex?		73	**45**
Mother had post-natal depression?	39		
Monitor child?		**45**	

A history of cervical screening or future cervical screening attendance intentions seemed not to be associated with HPV vaccination receipt (86, 87, 92, 93). An association was only shown in one study (12) but bias in this finding was unclear or plausible. Similarly, relationships between having a history of abnormal cervical screening results and HPV vaccination were not apparent (45, 87, 89, 103, n=1 low quality study, n=3 of medium quality), although positive and negative relationships have been shown in two single studies that were of medium quality (12, 89). Parents without a history of STIs or genital warts specifically have been shown to be more likely to have children who have not received the HPV vaccine (12, 45) but non-significant associations have also been reported (75, 12, 89) and all findings had an unclear risk of bias and the evidence for a previous STI diagnosis is uncertain. A history of cervical cancer (including area-level incidence of cervical cancer) has consistently been shown to not be associated with HPV vaccination receipt in four studies (n=1 of low quality, n=3 of medium quality) conducted in the USA and Canada. Age of first sex (45, 89), having had sex (86), number of sexual partners (89) and whether the girl has a boyfriend (45) all show non-significant relationships with HPV vaccination receipt in medium quality studies. The teenage pregnancy rate of the county the participant resides in has not been found to be associated with HPV vaccination receipt (93) but girls who themselves have ever been pregnant are less likely to have received the HPV vaccine (89). This latter study also found that girls who use condoms are less likely to have received the HPV vaccine. Both of these studies were of medium quality and conducted in the USA. Taken as a whole this evidence suggests that there is no role for a girl's previous sexual behaviour. One low quality study has shown that parents who have not spoken to their child about sex are more likely to have a child who has not received the HPV vaccine (73) but one medium quality study found no relationship (45), suggesting that the evidence is uncertain.

A number of factors were considered by single studies only so general conclusions cannot be drawn. One high quality study looking at childhood vaccines found children whose mother suffered from post-natal depression were more likely to be unvaccinated (39). A parent's political stance has been shown not to be associated with HPV vaccination receipt in two studies (45, 92; one low quality and one high quality). Parents who monitor their child to a lesser extent are more likely to have a child who has not received the HPV

vaccine (45, medium quality) but this study found family cohesion to not be associated with vaccination receipt.

Summary of lifestyle choices, past behaviour and past health outcome findings

There seems to be consistent evidence that parents who choose alternative lifestyles are more likely to refuse childhood vaccinations for their children. Children who have not received all of their previously recommended vaccines and children who have seen a doctor least frequently are more likely to be unvaccinated with childhood and HPV vaccinations. History of cervical screening, history of abnormal cervical screening results and a history of cervical cancer appear not to be associated with HPV vaccination receipt. This was also the case for the girls' previous sexual behaviour. All findings had an unclear risk of bias.

Vaccination-related attitudes (Table 2.6)

General concerns about vaccinations have been considered in a number of studies, all of which found that greater concern was associated with non-receipt of both the HPV vaccine and childhood vaccines. General concerns have included: concern about the need for booster doses, having a generally negative opinion about the vaccines and being concerned about family health in the context of vaccination. The four studies that have considered general concerns were of low or medium quality (10, 73, 74, 103).

Table 2.6: Vaccine-related attitudes for research question 1 (n=low quality, **n**=medium quality and n=high quality)

Factor (if yes/no, yes=high)	Positive association (high factor = more likely unvaccinated)	Negative association (low factor = more likely unvaccinated)	Non-significant result
General concerns	**10,** 73, 74, **103**		
Efficacy concerns	**10, 46, 75,** 92		**26**
Safety concerns	23, **26, 36, 46,** 73, 74, **79, 105**		23, 92, **105, 106**
Concern about sexual behaviour after vaccination	74, **103**		73
Concern about certain foods	**10**		
Believe vaccines to be important?		92, **105, 106**	23, **46**, 92, **106**
Not sure that the decision to vaccinate was the right one	**10**		
The earlier the parent became concerned about vaccines in the child's life	**10**		
Authorities should have responsibility for vaccination		**10**	
Exposed to conflicting opinions	**65, 106**		23
Fear of needles	**45**		**89**
Influenced by research	23		
Vaccine should be given to males			74
Distrust	**46,** 73, **106**		**46, 106**
Disagree with mandatory vaccination	**79**		

Specific vaccine efficacy concerns have also been shown to be related to both childhood vaccines and HPV vaccination in four studies (n=1 low quality and n=3 medium quality) although non-significant results for childhood vaccines were reported in one medium quality American study. The evidence suggests a probable role for vaccine efficacy concerns. The evidence for concern about safety is less clear, but is likely to follow the same pattern as vaccine efficacy concerns and general concerns. Eight studies have found concern about childhood and HPV vaccination safety to be associated with non-receipt (n=3 studies were of low quality and the rest were of medium quality; 23, 26, 36, 46, 73, 74, 79, 105), but non-significant findings have been reported in four studies (n=2 of which were low quality and n=2 were of medium quality; 23, 92, 105, 106).

Concern about sexual behaviour following HPV vaccination has been found to be associated with non-receipt in two studies (n=1 British study of low quality and n=1 Canadian study of medium quality; 74, 103) but one American study showed non-significant results (low quality; 73). This issue was specific to HPV vaccination and not considered by studies looking at childhood vaccinations generally. Parents' concern about feeding their children certain foods has been found to be associated with MMR vaccination acceptance in one medium quality British study (10). For all of these factors there is no evidence that parents with less concern are less likely to vaccinate.

Beliefs about the importance of vaccinations have shown negative and non-significant associations with childhood and HPV vaccination non-receipt, so the evidence for this factor is uncertain. Three studies (n=1 low quality and n=2 medium quality) reported that parents who thought vaccines were unimportant were less likely to vaccinate their child (92, 105, 106) and four studies (n=2 of low quality and n=2 of medium quality) reported non-significant findings (23, 46, 92, 106). There is no evidence that those who think vaccines are important are more likely to refuse vaccination.

Parents who have been exposed to conflicting opinions regarding vaccinations have been found to be less likely to vaccinate their child with childhood and HPV vaccines (65, 106) but these studies have an unclear risk of bias and non-significant findings have also been

reported for MMR vaccination (23). Fear of needles has been considered by two studies, both of medium quality that looked at HPV vaccination. One found that fear of needles reduced the likelihood that the HPV vaccine had been received (45) and one found non-significant associations (89), meaning that definitive conclusions cannot be drawn.

There was inconsistent evidence regarding trust. Various forms of trust have been considered including distrust of pharmaceutical companies and vaccination authorities. Greater distrust has been shown to be associated with a reduced likelihood that a child has received childhood vaccines or the HPV vaccine in studies that had an unclear risk of bias (46, 73, 106) but non-significant findings have also been reported in two medium quality studies exploring childhood vaccinations (46, 106). There was no evidence that greater trust results in greater likelihood of vaccination non-receipt.

Certain attitudes were considered by single studies only. Parents who believe that the HPV vaccination should be given to males are more likely to have vaccinated their child (74, low quality). Parents who report being influenced by research are less likely to have vaccinated their child against MMR (23, low quality). Parents who do not believe that the authorities should have responsibility for vaccination are less likely to have vaccinated their child against MMR (10, medium quality) and parents who disagree with mandatory vaccination are less likely to have had their daughter receive the HPV vaccine (79, medium quality). One British study of medium quality has shown that parents who were unsure whether their previous decision to vaccinate their child was the right one are more likely to have a child who has not received the MMR vaccine (10).

Summary of vaccine-related attitudes

No study that considered vaccine-related attitudes was of high quality and all findings show an unclear risk of bias. Many of the individual attitudes were considered by a small number of studies so the evidence for each was weak and unclear. There appeared to be consistent evidence that general concern about vaccination and concern about the efficacy of vaccinations are related to non-receipt of HPV vaccines and childhood vaccines. There was weak support for an association between concern about sexual behaviour following

HPV vaccination and HPV vaccination receipt and this concern was specific to HPV vaccination. A vaccine given to adolescents to protect from an STI is a novel event and was not explored in detail by any of these studies. There was also a possible role for vaccination safety.

Social cognition model concepts and knowledge (Table 2.7)

Perceived severity has shown both negative (10, 103) and non-significant associations with non-receipt of HPV vaccination and childhood vaccinations (75, 89, 105). All findings have an unclear risk of bias and the varying findings limit definitive conclusions from being drawn. The negative associations were reported in British and Canadian studies whereas all of the non-significant findings were reported in American studies, suggesting that the effect may be cultural.

Subjective norm beliefs have on the whole been found to be associated with childhood vaccine and HPV vaccination non-receipt (lower subjective norm, more likely to be unvaccinated; 10, 23, 73, 75, 89; two low quality and three medium quality studies). One study reported non-significant findings for MMR vaccination and subjective norms (23). One study considered comparative norms and found that those who did not believe that they were similar to their peers were more likely to have refused MMR vaccination for their child (10, medium quality British study).

Many studies have considered vaccination knowledge and both negative and non-significant findings have been reported. Six studies (n=2 of low quality and n=4 of medium quality; 36, 73, 79, 87, 49, 105) found low knowledge to be associated with vaccination non-receipt (both childhood vaccines and HPV vaccination) and five studies (n=2 of low quality and n=3 of medium quality) reported non-significant associations for knowledge (87, 89, 92, 103, 105). There is no evidence that high knowledge is associated with a greater likelihood of vaccination non-receipt.

Table 2.7: Social cognition model beliefs and knowledge for research question 1 (n=low quality, **n**=medium quality and n=high quality)

Factor (if yes/no, yes=low)	Positive association (high factor = more likely unvaccinated)	Negative association (low factor = more likely unvaccinated)	Non-significant result
Perceived severity		**10, 103**	**75, 89, 105**
Intention			**89**
Perceived susceptibility		73, **75**	
Normative beliefs		**10**, 23, 73, **75, 89**	23
Self-efficacy			**89**
Comparative norm (I am similar to my peers)		**10**	
Fear of disease			92
Barriers	**75**		**89**
Benefits		**46,** 73	**89**
Knowledge		**36,** 73, **79,** 87, **49, 105**	87, **89,** 92, **103, 105**
Perceived risk of negative effects of vaccination	23		
Anticipated regret if child became more sexually active	**75**		

A number of factors were considered by one study only so definitive conclusions cannot be drawn. Intention to receive the HPV vaccine and self-efficacy were not associated with vaccination receipt in one medium quality study from the USA (89). Fear of disease also showed non-significant associations with HPV vaccination in a low quality study performed in the USA (92). Parents who would anticipate regret if their child became more sexually active following HPV vaccination were more likely to have refused HPV vaccination for their child (75), and finally parents who perceive their child to be at risk of the negative effects of vaccination were more likely to have not vaccinated their child against MMR (23).

Summary of social cognition model concepts and knowledge

A number of social cognition model components have been considered by only one study. No study exploring social cognition model components was of high quality, causing concern about the risk of bias in the findings. There was weak evidence that perceptions of susceptibility are associated with HPV vaccination receipt. Normative beliefs have fairly consistently been found to be associated with vaccination non-receipt although the evidence is of unclear/plausible risk of bias.

Summary of the findings of review question 1

The evidence for studies helping to answer review question 1 was mostly of medium quality and findings were of an unclear risk of bias. Often only one study had considered each factor, limiting definitive conclusions. Studies of high quality were only used to investigate the influence of some demographic factors. Rarely was the evidence consistent so conclusions are generally tentative. For demographic factors clearer evidence was available for childhood vaccination receipt compared with HPV vaccination. Ethnic minority groups appeared at a greater risk of being unvaccinated against all vaccinations. Childhood vaccinations were less likely to have been received if the child was being raised by a single parent or unmarried parents, if their parents were employed and if the child was not the first born in the family. There appears to be no role for the gender of the child in influencing vaccination receipt. The type of clinic that the parent/child was recruited from appears to be related to vaccination receipt but a lack of consistency in defining clinic types

restricts more detailed conclusions from being drawn. Having a need for more information appears to be related to HPV vaccination although this conclusion may be rather simplistic as weak evidence suggested that children are more likely to be unvaccinated if more information was sought. The health of the child at the time of their vaccination appointment may influence vaccination receipt and health insurance status may also affect vaccination receipt. Children who had not previously received all of their recommended vaccinations and those who saw their doctor less frequently were more likely to be unvaccinated, as were children of parents who use complementary and alternative medicine. Parents' history of cervical screening, history of abnormal cervical screening results and a history of cervical cancer were not associated with HPV vaccination receipt, neither was a girl's sexual behaviour. General concerns about vaccination and concern about the efficacy of vaccinations were fairly consistently associated with vaccination receipt and there was weak support for concern about sexual behaviour following HPV vaccination and HPV vaccination receipt, with this concern being specific to HPV vaccination. Up until the development of an STI vaccine designed for receipt in adolescence, this issue has not been of concern and may require further investigation. Finally, of the social cognition model components that were considered in these studies, perceived susceptibility and subjective norms seemed most consistently associated with vaccination receipt.

Review question 2: What factors are associated with parents'/girls' intentions to refuse the HPV vaccine?

Demographic characteristics (Table 2.8)

Eleven studies explored associations between ethnicity and HPV vaccination intentions with eight reporting significant findings. Most of the studies were of medium quality but one significant and one non-significant study were of high quality. Five studies found intentions to refuse the HPV vaccine to be higher for the vaccination of non-Hispanic White children (12, 13, 30, 56, 96) but four studies found intentions to refuse to be higher in other ethnic minority groups (13, 26, 34, 96).

Five studies considered the role of SES. These studies measured SES at a postcode level, using income and using school type. Two studies with an unclear or plausible risk of bias found those with higher SES more likely to not intend to vaccinate against HPV (73, 96), one study of medium quality found the opposite (34) and one study of medium quality found that parents with a middling income had higher intentions to refuse (96). Non-significant results were reported in three studies (one of low quality, 15 and two of medium quality, 33, 35). The evidence for the role of SES is uncertain.

Degree of education appeared not be associated with HPV vaccination intentions. Five studies (showing an unclear risk of bias) reported non-significant results (15, 35, 34, 41, 82), although one study found more educated individuals had higher intentions to refuse (13) and two studies found less educated individuals were more likely to intend to refuse HPV vaccination (45, 96).

Table 2.8: Demographic factors for research question 2 (n=low quality, **n**=medium quality and n=high quality)

Factor (if yes/no, yes=high)	Positive association (high factor = more likely unvaccinated)	Negative association (low factor = more likely unvaccinated)	Direction cannot be assigned	Non-significant result
Ethnicity			Ethnic minority school: **34**; Black: **13**; non-Hispanic/Latino: **12, 13, 30, 56, 96;** Asian: **13, 34** non-white: 26, **96**	**33**, 41, **45, 82**
SES	73	**34**	Did not go to a state school: **96,** Middling income: **96**	15, **33**, **35**
Education	**13**	**45, 96**		15, **35, 34,** 41**, 82**
Child age		**17, 33**		**34, 45, 96**
Parent age	41	28		**13**, 15, **33, 45, 58, 82, 96**
Employment				**82**
Religion			Other Christian: **13**; Other religion: **13;** Born-again/evangelical**: 13;** Muslim: **34, 91**; Hindu/Sikh: **34,** Other: **82,** Protestant: **96**	41
Practicing a religion?	**13, 91,** 98			41
Marital status			Household with <2 parents in it: 41	**33, 82**
Child's gender			Male: **58**	
Parents' gender			Male: 41	**35, 58, 96**
Number of children in the household				41
Native speaker of country of study?		**34**		
Native of country of study?				**35**
Region of residence			Live in British Columbia/Yukon Territory: 41	**35**

There was inconsistent evidence for the impact of child's age on HPV vaccination intentions as three studies reported non-significant findings (34, 45, 96) and two studies showed that intentions to refuse were higher for younger children (17, 33). All of these studies were of medium quality indicating an unclear risk of bias for these results. The findings were more consistent for parents' age and intentions with seven studies (one of low quality, six of medium quality) reporting that parents' age was not related to intentions (13, 15, 33, 45, 58, 82, 93). However, two studies, both of high quality found that older parents and younger parents were more likely to intend not to vaccinate a child against HPV (41, 28). The evidence for the role of parents' gender was unclear. One high quality study found fathers had higher intentions to refuse (41) but three medium quality studies reported null findings (36, 58, 96). Regarding marital status the evidence was also unclear, one high quality study reported that single parents were more likely to intend to refuse to vaccinate against HPV (41), but two medium quality studies reported null findings for the effect of marital status on intention (33, 82).

Five studies reported significant associations between religion and intention but there was very little consistency in the religious beliefs that were associated with higher intentions to refuse (13, 34, 91, 82, 96, all medium quality). One high quality study found null findings for religion (41). There appeared to be more evidence for the degree of religiosity in those who identified themselves as having a religion as three studies (one of low quality and two of medium quality) found that those who were more engaged with their religion had higher intentions to refuse (13, 91, 98). One high quality study reported null findings (41).

A number of demographic factors were considered by just one study. A medium quality study found vaccination intentions to refuse were higher if the target child was male (58). Parents who were not native speakers of the country where the study was conducted had higher intentions to refuse (34, medium quality), but non-significant findings were reported for whether the respondent was born in the country that they reside (35, medium quality). Mothers' employment was not shown to be related to vaccination intentions in one medium quality study (82). Number of children in the household was not found to be associated with intention in a high quality study (41). Region of residence in the USA was found to be

related to intention in this same high quality study (41) but living in a rural location in Australia specifically was not associated with intention (35, medium quality).

Summary for demographic factors

A number of studies considered the role of demographic factors in affecting HPV vaccination intentions. Mainly the findings were of unclear risk of bias, although two high quality studies explored demographic factors. A number of factors were considered by single studies only, restricting generalisations. Non-Hispanic and ethnic minority individuals appeared to have higher intentions to refuse. Parents' age and education seemed not to be associated with intention. Although there was inconsistent evidence for the role of religion, those who are practising a religion to a greater extent may be less likely to intend to vaccinate a child.

Practical factors (Table 2.9)

Only three distinct practical factors were explored when considering HPV vaccination intentions and each factor was investigated by one study only. One high quality American study found higher intentions to refuse in those without health insurance (85). One study manipulated what they told participants that the HPV vaccine protected against. This medium quality study found that intentions to refuse were higher if the vaccine was described as protecting against HPV solely (and not specifically cervical cancer or genital warts) or as protecting against genital warts (and not cervical cancer, 76). Finally, information use by respondents (including the media, friends/family, leaflets and the internet) was not associated with vaccination intentions in a British study of medium quality (33).

Summary for practical factors

Only three studies have considered practical factors associated with intention so generalised conclusions could not be drawn. All of the studies were of medium quality.

Table 2.9: Practical factors for research question 2 (n=low quality, **n**=medium quality and n=high quality)

Factor (if yes/no, yes=high)	Positive association (high factor = more likely unvaccinated)	Negative association (low factor = more likely unvaccinated)	Direction cannot be assigned	Non-significant result
Format of information				**33**
Health insurance status			No insurance: 85	
Type of vaccine			Protects solely against HPV (and not specifically cervical cancer or genital warts): **76;** Protects solely against genital warts (and not cervical cancer): **76**	

Lifestyle choices, past behaviour and past health outcome findings (Table 2.10)

There was consistent support that intentions to refuse vaccination against HPV were higher when the target child had not received all of their previously recommended vaccinations or had delayed a previously recommended vaccine (15, 41, 51, 77, 81), although this finding was of unclear risk of bias. However, in a similar vein having had a bad vaccination experience previously was not associated with vaccination intentions in one British study of medium quality (77). Mothers who are not willing to have the HPV vaccine themselves seemed to have higher intentions to refuse to vaccinate a daughter against HPV, although only two medium quality studies explored this (51, 82).

Not having a history of attending for cervical screening, or not intending to do so was associated with higher intentions to refuse vaccination in two medium quality studies (26, 91), and null findings were reported in one medium quality British study (33). Intentions to refuse were higher in those with a history of abnormal cervical screening results in one high quality study, but not in one medium quality study. A similar pattern was seen for having experienced cancer (including knowing someone who has been diagnosed with cancer), one high quality study reported null findings (41) and one medium quality study found that those who have not experienced cancer have higher intentions to refuse HPV vaccination (82). As a result, the evidence for previous cancer and cervical cancer prevention experience was uncertain.

The political orientation of the parent was considered in three studies. Two medium quality studies found conservatives in the USA to have higher intentions to refuse HPV vaccination for their daughters (13, 96), but one low quality British study reported null findings (98). More evidence is needed here in order to draw more definite conclusions.

Table 2.10: Lifestyle choices, past behaviour and past health outcome for research question 2 (n=low quality, **n**=medium quality and n=high quality)

Factor (if yes/no, yes=high)	Positive association (high factor = more likely unvaccinated)	Negative association (low factor = more likely unvaccinated)	Direction cannot be assigned	Non-significant result
Bad previous vaccination experience?				**77**
Received previous vaccines?		**15,** 41, 51, **77,** 81		
Mother willing to have the vaccine?		51, **82**		
History of cervical screening?		**26, 91**		**33**
History of abnormal cervical screening?		**26**		**45**
Experience of cancer?		**82**		41
Political stance?			Conservative: **13, 96**	98
Talk to child about sex?		73, **82**		**45**
Have spoken to others about the vaccine?			Want to involve child in the decision: 81	
Spoken to daughter about cervical screening?		26		
History of STI?		**45**		
Ever pregnant?	85			
Use condoms?		85		
Child has boyfriend/girlfriend?				**45**
Number of sexual partners	85			
Age of first sex				**45**
Monitor child		**45**		
Greater family cohesion				**45**

Parents who have not spoken to their daughter about cervical screening were found to have higher intentions to refuse to vaccinate in a high quality study (26). Parents who have not spoken to their child about sex or who did not feel comfortable talking to their children about sex were more likely to intend refuse vaccination (73, 82, one study of low quality and one study of medium quality) although one study reported null findings for this factor (45). Again, more evidence is required here in order to draw definitive conclusions.

A number of factors were considered by single studies only, meaning that definitive conclusions could not be made about their role in vaccination intentions. Not having a history of STI infection was found to be associated with higher refusal intentions in a medium quality study (45) and ever being pregnant was related to girls having higher intentions refuse the HPV vaccine themselves (85, high quality). Lower condom use was also associated with higher refusal intentions in this same high quality study as was having a higher number of sexual partners. There was no relationship for age of sexual debut in one medium quality study (45). Intentions were not related to whether the target child had a boyfriend in this same American study. Further findings from this study were that intentions to refuse were higher if a parent monitored their child to a lesser extent and null findings for the role of family cohesion. Finally, parents who wanted to involve their child in the decision to receive the HPV vaccine had higher intentions to refuse (81).

Summary for lifestyle choices, past behaviour and past health outcomes

A large number of factors were considered by only one study which limits the ability to draw definitive conclusions about the importance of this factor. High, medium and low quality studies explored lifestyle choices, past behaviour and past health outcomes although the findings overall showed an unclear risk of bias. Only previous vaccination receipt was consistently associated with HPV vaccination refusal intentions.

Vaccine-related attitudes (Table 2.11)

Having general concerns about vaccinations or the HPV vaccine was consistently associated with higher vaccination refusal intentions in five studies, although this finding was of unclear risk of bias (15, 73, 77, 82, 94). The types of general concerns explored included length of time that the vaccine has been on the market for, dislike of vaccinations generally and concern that there are already too many vaccinations in the immunisation schedule. Two medium quality studies reported that greater concern about the efficacy of the vaccine was associated with higher refusal intentions (15, 94). Respondents with greater concerns about safety had consistently higher refusal intentions in seven studies with an unclear risk of bias (15, 58, 73, 77, 82, 91, 94), although one study reported null findings (58). Concern about sexual behaviour following HPV vaccination was often related to refusal intentions (15, 41, 58, 82, 91, 96) in studies from a number of countries, although this finding had an unclear risk of bias and one low quality study reported null findings (73). However, weak evidence suggested that there is not a role for how liberal a parents' sexual values are (two studies of medium quality reported null findings, 45, 58, and one study of low quality reported significant results, 15). Similarly to the evidence reported for review question 1, these factors were only assessed in studies exploring HPV vaccination. Parents who disagreed that vaccinations were important held higher refusal intentions in one low, one medium and one high quality study (41, 73, 77), suggesting that beliefs about importance are relevant to vaccination intentions. A greater concern about needles was associated with higher refusal intentions in two medium quality studies (34, 45). Distrust of governments or pharmaceutical companies was explored in two studies (one low quality and one medium quality study) that found greater distrust associated with higher refusal intentions (73, 77).

Table 2.11: Vaccine-related attitudes for research question 2 (n=low quality, **n**=medium quality and n=high quality)

Factor (if yes/no, yes=high)	Positive association (high factor = more likely unvaccinated)	Negative association (low factor = more likely unvaccinated)	Direction cannot be assigned	Non-significant result
General concerns	**15,** 73, **77, 82, 94**			
Efficacy concerns	**15, 94**			
Safety concerns	15, **58**, 73, **77, 82, 91, 94**			**58**
Concern about sexual behaviour after vaccination	15, 41, **58, 82, 91, 96**			73
More liberal sexual values		15		**45, 58**
Believe vaccines are important?		41, 73, **77**		
Fear of needles	**34, 45**			
Distrust	73, **77**			
Vaccine should be given to males?		81		
Not sure that the decision to vaccinate was the right one				**77**

Two factors were only considered by single studies. Parents who were uncertain whether their previous decision to vaccinate a child was the right one were no more or less likely to intend to vaccinate their child (77, medium quality) and Dutch parents who did not believe that the HPV vaccine should be given to males held higher refusal intentions (81, low quality).

Summary for vaccine-related attitudes

Studies of low, medium and high quality considered vaccine-related attitudes although on the whole the conclusions drawn had an unclear risk of bias. A number of attitudes were found to be consistently associated with higher refusal intentions including general concerns about vaccination, concerns about efficacy and parents questioning the importance of vaccinations. Concern about sexual behaviour after vaccination was associated with higher refusal intentions and was specific to HPV vaccination only. Similarly to the findings reported in review question 1, it is highly likely that this novel issue is relevant to HPV vaccination decision making. There was weaker support for the role of fear of needles and trust.

Social cognition model concepts and knowledge (Table 2.12)

Subjective norm beliefs were shown to be associated with vaccination intentions with five studies reporting that those with lower subjective norm beliefs had higher refusal intentions (15, 41, 82, 85, 91, findings unlikely to change), although one study reported null findings (41, high quality). One study explored descriptive norms, finding that those who thought others would not vaccinate had higher refusal intentions themselves (82, medium quality). Knowledge was fairly consistently associated with vaccination refusal intentions and this finding had an unclear risk of bias or was unlikely to change (41, 58, 82, 85), although one low quality British study reported null findings for knowledge (15).

Table 2.12: Social cognition model beliefs and knowledge for research question 2 (n=low quality, **n**=medium quality and n=high quality)

Factor (if yes/no, yes=high)	Positive association (high factor = more likely unvaccinated)	Negative association (low factor = more likely unvaccinated)	Direction cannot be assigned	Non-significant result
Perceived severity		15, **82,** 85		**34**
Perceived susceptibility		**34,** 41**, 58, 82, 91**		
Subjective norm		**15,** 41, **82,** 85, **91**		41
Descriptive norm		**82**		
Worry about disease	15			
Barriers	15, **34,** 85, **94**			
Benefits		15, **34**, 73, **82**		
Knowledge		41**, 58, 82,** 85		15
Self-efficacy		41		
Consideration of future consequences		97		
Need for internal consistency		100		

Individuals with lower perceptions of risk were shown to have higher refusal intentions to vaccinate in four medium quality and one high quality study (34, 41, 58, 82, 91), with every study being performed in a different country. Consistent findings were reported for benefits and barriers. Four studies of varying quality reported that individuals who perceive more barriers are more likely to have higher refusal intentions (15, 34, 85, 94) and similarly four studies showed that those who believed there were fewer benefits to vaccination were less likely to intend to vaccinate (41, 58, 82, 85, n=2 studies of low quality and n=2 studies of medium quality), although one low quality study reported non-significant findings (15).

The evidence was less clear for perceptions of severity with three studies finding lower perceptions of severity to be associated with higher refusal intentions (unclear risk of bias, 15, 82, 85) but null findings reported in one study (medium quality, 34). Three factors were considered by single studies. Having lower self-efficacy was related to higher refusal intentions in a high quality study (41), as was having lower consideration for future consequences (97, low quality study) and having a low need for internal consistency (100, low quality study).

Summary for social cognition model concepts and knowledge

The quality of the evidence for social cognition model concepts and knowledge was greater than for other categories. A number of studies were of high quality allowing some certainty that the conclusions drawn would not change. However, the majority of conclusions had an unclear risk of bias. Subjective norm beliefs and knowledge showed consistent and reliable associations with refusal intentions and perceptions of risk and barriers and benefits were also related to refusal intentions, although these conclusions were weaker.

Summary of the findings of review question 2

The evidence used to help to answer review question 2 was mainly of medium quality causing some concern about the risk of bias of conclusions drawn. Conclusions cannot be made about the role of practical factors in vaccination refusal intentions because too few studies considered these factors. Methodologically stronger studies reported findings for

social cognition model components and knowledge so more definite conclusions can be drawn for these factors. Individuals who are not from Hispanic ethnicities and those from ethnic minorities seem more likely to intend refuse vaccination. Parents' age and education appear unlikely to be related to intentions. Having previously not received other vaccinations or having delayed a vaccination in the past may be associated with vaccination refusal intentions. General concerns about vaccinations, concerns about vaccine efficacy specifically and concerns about sexual behaviour following HPV vaccination receipt were all associated with intentions. Concern about sexual behaviour was specific to HPV vaccination only and as it was also deemed influential in review question 1, it is likely to play an important role in HPV vaccination decision making. There was a possible role for fear of needles and lack of trust. Subjective norm beliefs and knowledge were strongly associated with refusal intentions and there are potential relationships for perceptions of risk and perceptions of the barriers and benefits of vaccination.

Review question 3: What are the reasons that parents/girls give to explain why they have not received a vaccine recommended in the UK childhood immunisation schedule (intention to not receive or actual non-receipt for HPV vaccine)?

Description of the studies

The studies included in the review that helped answer review question 3 used a variety of methods to elicit parents/girls reasons to explain why they had not received a recommended vaccine (or would intend to do so). Some studies were purely qualitative and employed focus groups or interviews. Other studies asked participants to answer an open response question in a questionnaire as well as assessing actual non-receipt or intention to not receive a vaccine.

Demographic factors (Table 2.13)

Nine studies found respondents to report that the child's age would prevent them from vaccinating a child or has already prevented them, or has caused them to delay vaccination (4, 8, 14, 17, 40, 93, 99, 103, 111). The risk of bias for this finding was unclear; however the number of studies reporting this finding suggests that age is important. In most cases it

was deemed that the child was too young to receive the vaccine, but in one study girls believed they were too old to receive the HPV vaccine. Religious values were cited as a reason for preventing HPV and MMR vaccination (intention, receipt and completion) in four studies all conducted in the USA, although this finding had an unclear or plausible risk of bias (17, 29, 46, 92). Parents in two medium quality studies reported that their living situation caused them to delay vaccination or had prevented them from vaccinating their child with childhood vaccines (40, 52). Problematic living situations included having a transient lifestyle, living abroad or not having a permanent place to live.

Table 2.13: Factors for research question 3 (n=low quality, **n**=medium quality and n=high quality)

Factor	Study
Child's age	**4, 8, 14, 17, 40,** 93, 99, **103,** 111
Religion	**17,** 29, **46**, 92
Living arrangements	**40, 52**
Want to get vaccine at GP and not in school	**32**
Need more information about vaccine	**4, 8, 17,** 24, **40**, **45, 56, 67, 71,** 72, **80**, **89**, 92, 93, 99, **103,** 111
Gained information from the media	29
Easy access to the clinic	**26, 40, 89**
Child unwell	**8**, **26**, 29, **36, 40, 52**
Cost/health insurance	**17, 26, 89,** 92, **107,** 111
Bad previous vaccination experience	29
General practical difficulties	**8, 36, 40,** 87, **89,** 92, 107, 111
Forgot	**26, 36, 40, 89**
Preference for complementary and alternative medicine	29**, 40**
Want to involve daughter in the decision	**17**
Ever pregnant?	**67,** 87
History of HPV infection	87

Table 2.13: Factors for research question 3 continued …

Factor	Study
Moral/ethical values	**46, 107**
General concerns	**8, 13, 14, 40, 67, 71, 80,** 81, 93, 99, **103, 107**
Efficacy concerns	**26, 36, 46,** 87, **95, 107**
Safety concerns	**13, 14, 17, 19**, 24, **26,** 29, **36, 40, 46, 53, 67, 71,** 81, 87, 92, **93, 95,** 99, **103, 107, 110,** 111
Concern about sexual behaviour after vaccination	**4, 8, 13, 53,** 72, **80,** 81, 92, 93, **95, 103**
Importance of vaccination	**8, 14,** 29, **32, 36, 40, 45, 52, 67,** 99, **103, 107**
Fear of needles	**8, 17, 45, 67**
Distrust	25, **40,** 92, **103**
Undecided	**36**
Perceived severity	**46**
Perceived susceptibility	**8, 13, 14, 17, 19**, 24**, 40, 45, 46, 51, 56,** 64, **67, 80,** 87, 92, 93, 99, **103, 107, 110**
Subjective norm	29**, 67, 80, 87,** 92, 93, **103**
Benefits	**40, 107**
Perceived risk of negative effects of vaccination	51

Practical factors (Table 2.13)

An often reported factor that would or has prevented HPV vaccination was a need for more information about the vaccine (4, 8, 17, 24, 40, 45, 56, 67, 71, 72, 80, 89, 92, 93, 99, 103, 111; plausible or unclear risk of bias). The specific information requested included needing to know more about the side-effects and safety of the vaccine, the prevalence of HPV and the benefits of receipt, the immunisation schedules specifically and one study found participants reported that they did not know that more than one dose was required. One study found that parents stated that their use of the media for information about MMR vaccination had caused them to refuse vaccination for their child (29).

Having concerns about cost or lack of health insurance would or has prevented HPV vaccination or use of childhood vaccines in six studies, although this finding had an unclear risk of bias (17, 26, 89, 92, 107, 111). Six studies found parents to have prevented or delayed HPV vaccination or childhood vaccinations because of their child's health status. The child being unwell at the time the vaccine was due, the child having already had the disease that the vaccine was designed to prevent and contraindications were all cited, although the risk of bias was unclear (8, 26, 29, 36, 40, 52). Participants said that forgetting to get the vaccine had prevented or delayed vaccination receipt (both childhood vaccines and HPV vaccination) in four studies of medium quality (26, 36, 40, 89). In studies from the USA, some respondents found difficulty of access to the vaccination clinic had caused them to delay vaccination or had prevented them from receiving vaccines (HPV and childhood vaccines). Access problems included transportation issues and being unable to get an appointment (26, 40, 80; unclear risk of bias).

General practical difficulties associated with the process of receiving childhood vaccines or the HPV vaccine have been reported to have prevented or delayed vaccination receipt in eight studies (8, 36, 40, 87, 89, 92, 107, 111; unclear risk of bias). Practical difficulties included needing to receive vaccines in a particular order, feeling overwhelmed by the number of vaccines required, having to arrange supervision of other children whilst the target child receives the vaccine, the vaccine not being available or not offered, not having enough time and not knowing where to go to get the vaccine.

Two studies highlighted issues that were not reported in any other study. A study from New Zealand found parents to have refused tetanus vaccination offered in school because they preferred to receive it from their GP (32, medium quality). Parents in another low quality American study said that a previous bad vaccination experience had prevented them from giving their child the MMR vaccine (29).

Lifestyle choices, past behaviour and past health outcomes (Table 2.13)

Respondents rarely reported that their lifestyle choices, past behaviour and past health outcomes had affected their vaccination decisions and all studies that did find participants to cite these factors were from the USA. A preference for or use of complementary and alternative medicine had caused parents in two studies (n=1 low quality and n=1 high quality) to delay or refuse childhood vaccinations (29, 40). Another two studies found adolescent girls to say that they had refused the HPV vaccine, or failed to complete the schedule because they had become pregnant (67, 87, plausible or unclear risk of bias). One medium quality study found that parents who did not intend to vaccinate their daughter against HPV made this decision because they wanted to involve their daughter in the decision (rather than making it for her; 17). Finally, in one low quality study girls said that they had not received the HPV vaccine because they had already been infected with HPV (87).

Vaccine-related attitudes (Table 2.13)

The most frequently discussed attitude that had prevented or would prevent HPV vaccination or childhood vaccination was having safety concerns about vaccination (13, 14, 17, 19, 24, 26, 29, 36, 40, 46, 53, 67, 71, 81, 87, 92, 93, 95, 99, 103, 107, 110, 111; unclear risk of bias). Safety concerns cited included fear of side effects, believing that vaccines are dangerous, fear of contracting the disease through vaccination, concern about overloading the immune system and preferring to wait to see whether problems arise with the vaccine.

General concerns preventing vaccination or causing respondents not to intend to vaccinate (HPV vaccine and childhood vaccines) was cited in studies that were performed in a number of countries (8, 13, 14, 40, 67, 71, 80, 81, 93, 99, 103, 107; unclear risk of bias).

Concerns expressed included worry about the vaccine being offered as part of a study, concern about the adjuvant, unease about the trauma of the vaccination process and concern about the novelty of the vaccine. Respondents reported that efficacy concerns had prevented or would prevent HPV vaccination or the use of childhood vaccines in six studies (26, 36, 46, 87, 95, 107; unclear risk of bias). Concern about sexual behaviour was reported by some parents to have prevented (or would prevent) them from letting their child receive the HPV vaccine (4, 8, 13, 53, 72, 80, 81, 92, 93, 95, 103; unclear risk of bias). The specific concerns associated with this included worry that consent condones sexual activity, believing that the vaccine will encourage sexual promiscuity and concern about girls reaching sexual debut earlier as a result of the vaccine. Similarly to the findings of review questions 1 and 2 such, concerns were only raised in studies exploring HPV vaccination.

In many studies respondents stated that their belief that vaccinations are not important had or would cause them to not receive childhood vaccines or HPV vaccination (8, 14, 29, 32, 36, 40, 45, 52, 67, 99, 103, 107; unclear risk of bias). Some believed that alternative methods of preventing infection/disease were sufficient. Trust was reported to have caused respondents to have delayed or refused childhood vaccines or HPV vaccination in studies from the USA and Canada (25, 40, 92, 103; plausible or unclear risk of bias). Participants reported distrust of medical communities and the information they provide, sources of information generally, the government, and others believed that vaccination is a ploy for pharmaceutical companies to make money. A fear of needles or parents believing that their child was scared of needles had prevented HPV vaccination (or intention to receive the vaccine) in four studies of medium quality (8, 17, 45, 67). In the USA parents stated that they had refused childhood vaccines for their child because of their moral or ethical values (46, 107; both medium quality). These values included opposition to the use of aborted cell lines, use of foetal tissue or blood, animal testing and opposition to vaccination mandates.

Social cognition model concepts (Table 2.13)

Perceptions of susceptibility were the most commonly raised social cognition model belief that had prevented respondents from vaccinating their child against childhood vaccines or HPV vaccines (or from intending to do so for HPV vaccination); this finding had an unclear

risk of bias (8, 13, 14, 17, 19, 24, 40, 45, 46, 51, 56, 64, 67, 80, 87, 92, 93, 99, 103, 107, 110). Respondents stated the following susceptibility concerns as being important: not believing that their child is at risk of infection or will not be for some time, not believing that the child is sexually active, having only had one sexual partner, being already married or not believing in sex before marriage. One study of low quality found parents to report that their belief that their child was at risk of the negative effects of HPV vaccination caused them to decline to allow their child to receive the vaccine (51).

Normative beliefs were also raised as having prevented HPV or MMR vaccination in seven studies (29, 67, 80, 87, 92, 93, 103; unclear risk of bias). Normative beliefs that were influential included reporting that friends, family or their doctor discouraged the vaccine's use, the doctor not offering the vaccine to the respondent or wanting to get the opinion of a healthcare professional first.

In two American studies of medium quality participants reported that low perceived benefits of childhood vaccination had caused them to either delay or refuse vaccination for their child (40, 107). Low perceptions of severity were cited as a reason for failing to complete the childhood vaccination schedule in one American study (46, medium quality).

Summary of the findings of review question 3

The qualitative literature has highlighted a number of factors that are influential in causing parents and adolescents to have delayed, refused or failed to complete vaccination schedules for HPV vaccines and childhood vaccines and also caused individuals to fail to intend to vaccinate against HPV. All of the findings were of an unclear risk of bias meaning that we should be cautious about the validity of the findings. The demographic factor that was most consistently associated with non-receipt was the child's age, with the preference, on the whole for older children to be vaccinated. Knowledge deficits were frequently stated as another cause of vaccination non-receipt, as were financial concerns and general practical difficulties. Lifestyle choices, health behaviours and past health outcomes were less frequently raised as affecting vaccination decisions. Concerns about vaccination, including general, safety and efficacy concerns, were a major cause of

vaccination non-receipt both for HPV vaccines and childhood vaccines. Concerns about sexual behaviour following HPV vaccination was a concern specific to HPV vaccination and was regularly reported to have affected non-receipt of the HPV vaccine. The fact that this factor was deemed influential in quantitative and qualitative research, suggests that it is an important issue influencing vaccination decision making and requires further enquiry. Believing that vaccines were not important appeared to be influential also. Perceptions of invulnerability seemed to influence parents' and adolescents' vaccination decisions or intentions, as did normative beliefs.

Discussion of the findings of existing reviews

The literature search identified ten reviews that had considered reasons for vaccination non-receipt. Three were systematic reviews and the remaining articles were summaries of available literature (9, 20, 38, 50, 69, 70, 88, 101, 112, 114).

The present review updated a systematic review exploring reasons for vaccination non-receipt in studies conducted before 2005 (Falagas & Zarkadoulia, 2008). This review of 39 studies concluded that vaccination non-receipt was affected by parental-childhood characteristics and healthcare structure/professional characteristics. Some of their findings concur with the present review: demographic parental-childhood characteristics associated with non-receipt were being of a non-white ethnicity, late birth order and having an unmarried mother. However, they also found non-receipt to be associated with not having a religion, the child being older, the mother being younger, where the child lived and having a larger family size. Socio-economic factors within this category that were not highlighted as influential in the present review included having a low SES, low income, having to pay for immunisations, having less educated parents, not having health insurance and attending a state school. Attitudinal factors within parental-childhood characteristics that concurred with the present review included negative beliefs towards vaccinations and fear of side effects; but they also noted a role for parents' perceptions of controlling health and their sense of responsibility. Other important parental-childhood factors reflected the practical factor findings and lifestyle choice, health behaviour and health outcome findings for the present review: non-receipt was related to having a lack of knowledge, not

remembering appointments, the schedule of the vaccination, the immunisation status of the child, sick child delays and well-child visit delays, lack of childcare for other siblings, time constraints and having received conflicting information. Healthcare structure/professional characteristics reported to be influential included having a private healthcare provider, inadequate support from healthcare providers, inadequate support from the social environment, lack of healthcare structure, doubts about the healthcare provider's knowledge, accessibility problems, having had previous negative interactions with healthcare providers, long waiting times in clinics, previous traumatic vaccination experiences, physicians being reluctant to administer vaccination and not receiving reminders to have the vaccine. These factors did not come out of the present review. In contrast to the present review, the review was limited as it did not consider the quality of the evidence for each factor and did not examine whether studies were powered to detect effects.

The other reviews identified in the literature search were of varying quality and only two were systematic reviews. Others were much more unsystematic in their approach, did not describe how the review was conducted and did not elaborate on their results (for example, one reported that 'ethnicity' was associated with vaccination non-receipt without specifying details). There was not a great deal of consistency between reviews in the influence of demographic factors on vaccination non-receipt. Being an older child was the only factor reported by a number of reviews to be influential but one review did report that younger children were more likely to remain unvaccinated. Practical issues that were often reported in the reviews to be important included the child's health (previous negative vaccination experience, sick at the time of vaccination or too little contact with physicians), forgetting appointments and problems with childcare for other children and lack of access to healthcare. Fear of side effects/concern about safety was the only vaccine-related attitude to regularly be cited as influential in the reviews. A number of social cognition model components were also reported to be related to vaccination non-receipt; perceived susceptibility, severity and efficacy, subjective norms, low knowledge and negative vaccination beliefs were frequently suggested as being related to vaccination non-receipt.

One theory-informed review described the literature associated with parental immunisation decision making and developed a model to summarise the process (Sturm et al., 2005). The model highlights the importance of: social-environmental factors (cultural attitudes, social norms, media coverage); parent-specific/personal factors (cognitive heuristics, health beliefs), interface with health care (provider attitudes, access to healthcare), institutional policies, physical environment (incidence of vaccine-preventable diseases). Personal factors were described as the most important factors in influencing vaccination receipt; social-environmental factors shape parental beliefs, as do provider attitudes. The strength of the influence of provider attitudes is dependent on parents' trust in authorities. Provider systems, such as reminder systems, influence the salience of immunisation in the parents' competing concerns and priorities, and institutional policies may enhance the perceived importance of immunisation or increase parental resistance to vaccination. Similarly to the present review, the authors assert that the academic literature provides evidence supporting the importance of norms, including provider attitudes, the importance of susceptibility, benefits and barriers and competing health claims (e.g. getting child to school), but also suggested that the media, perceived severity, self-efficacy, omission bias, protected values (values that are not amenable to change) and framing also play a role, which did not come out of the present review. The authors acknowledged that there are some inconsistencies in the relative importance of the various concepts due to methodological differences between studies.

Differences between these reviews and the present review may be explained by their considering studies published before 2005, prior to the influx of studies exploring the HPV vaccine. The HPV vaccine may be perceived differently from existing vaccinations because of a variety of factors. The vaccine is given to older girls who are more likely to be involved in the decision making process than young children receiving existing vaccines. It is also likely that peer pressure and social peer norms will be an important influence on older girls' vaccination decisions. The HPV vaccine is generally being delivered in schools in the UK. This means that nurses come to the girls, rather than the girls having to seek out vaccination and so accessibility issues may be less important in informing vaccination uptake. Finally, the novelty of the vaccine is likely to be influential in informing parents'/girls' vaccination decision and its relationship to sexual behaviour

has been shown to be pertinent to parents' making decisions about whether to vaccinate their daughter against HPV.

DISCUSSION

The present review aimed to identify the factors that are associated with the non-receipt of vaccines recommended in the UK childhood immunisation schedule or intentions to refuse HPV vaccination and within both of these contexts to report the reasons that participants give to explain why they have refused a vaccine in the past or intend to refuse the HPV vaccine in the future. The review benefited from taking a systematic approach, exploring the methodological quality of the evidence and the findings of the review were triangulated to other reviews to increase the reliability of the results. Eighty-eight empirical studies were included in the review and the factors identified could be classified into five categories: demographic characteristics; practical factors; lifestyle choices, past behaviour and past health outcomes; vaccination-related attitudes and social cognition model concepts and knowledge. A larger number of studies considered the HPV vaccine as opposed to early childhood vaccinations. This is likely to reflect the proliferation of interest in HPV vaccination in recent years rather than a particularly reduced interest in early childhood vaccination uptake.

Demographic factors

This review demonstrated very little consistency in the role of demographic factors in influencing vaccination non-receipt. The non-significant findings may be more reliable. The child's gender was not associated with actual vaccination non-receipt and parents' age and parents' education were not related to vaccination intentions. Studies exploring vaccination intentions found lower intentions in non-Hispanic and ethnic minority groups, but studies exploring actual vaccination non-receipt suggested that only ethnic minority groups are more likely to have not received a vaccination. The finding of lower intentions in non-Hispanic groups is confusing given that minority groups also had lower intentions. It may be that comparisons are not appropriate due to the varying definitions of ethnicity. The finding that individuals from ethnic minority groups are more likely to have not received a vaccination is concerning as in UK populations they already suffer poorer health

(Cooper, 2002). Although it is difficult to compare findings for ethnic groups between countries due to the prevalence of different ethnicities and the variety of ways that ethnicity is classified, it is likely that the poorer health experienced by ethnic minorities in the UK is reflective of the experience of ethnic minorities in other countries. Studies of actual non-receipt of early childhood vaccinations found children of single or unmarried parents; of employed mothers and who were not the first born in their family were more likely to have not received a vaccine. Vaccination coordinators should pay special consideration to ensuring that children from these types of families come to receive their recommended vaccines by exploring the factors that are preventing these groups particularly from doing so.

Practical factors

There was not a great deal of consistency between the findings of each review question in the role for practical factors affecting vaccination non-receipt. Practical factors were not strongly associated with vaccination intentions. This is unsurprising as daily events and hassles are often unpredictable and cannot be factored into vaccination intentions. In reality though, a parent with the strongest beliefs about their child's susceptibility to a vaccine preventable infection may delay vaccination if their bus were not to turn up to take them to the vaccination appointment and this could not be anticipated. The reviews and studies considering actual vaccination non-receipt both highlighted the importance of the child's health (illness at the time of vaccination, having reacted badly to vaccines in the past and allergies) in influencing vaccination non-receipt. Decisions about postponing vaccination because of illness may not be simple for parents. The NHS immunisation website recommends not vaccinating a child when he is ill, but also states that vaccination need not be prevented because of a cold or cough, which are both likely to be interpreted as 'illness' by a parent (NHS Choices, 2010). Vaccination non-receipt because of child illness may be an example of appropriate non-receipt or may reflect parents making a personal, although uninformed, decision for their child. Lack of access to healthcare, including not having health insurance and having transportation problems were associated with vaccination non-receipt in both existing reviews and in actual non-receipt in the present review. The review also highlighted that parents who have problems finding childcare for other children whilst the target child is being vaccinated were also more likely to have not

had their child vaccinated. These factors appear to relate to poverty and so should be considered by governments if vaccination non-receipt is to be reduced. Finally, the review raised the issue of forgetting appointments as being important in affecting vaccination non-receipt. Putting systems in place to remind parents that appointments are due has been shown to improve childhood vaccination, particularly telephone call reminders from surgeries (Jacobson & Szilagyi, 2005).

Lifestyle choices, past health behaviours and health outcomes

Few lifestyle choice, past health behaviour and health outcome factors were shown to be strongly associated with vaccination non-receipt. These factors were not considered in any of the existing reviews and were not raised in the qualitative studies. Children who had not previously received all of their recommended vaccinations or who had previously had a vaccination delayed were more likely to have refused vaccination or parents' intentions to refuse a vaccine were higher. This suggests that parents may use their previous vaccination decisions as a heuristic to help them decide about future vaccines, especially novel ones. This self-identity of being a 'vaccination refuser' may be difficult to counter and perhaps the greatest efforts to encourage vaccination should occur with the first vaccines that children are offered with the intention of this impacting on future vaccination decisions. Having a preference for, or previous use of, complementary and alternative medicine was associated with greater actual vaccination non-receipt. For HPV vaccination receipt previous history of cervical cancer screening, history of abnormal cervical screening results and history/experience of cervical cancer were consistently not related to vaccination receipt. This was also the case for the girls' sexual behaviour. It is useful to know that there is no need to measure these factors when exploring reasons for vaccination non-receipt in the future.

Vaccine-related attitudes

Vaccination-related attitudes were considered separately from social cognition model concepts as there were a variety of attitudes identified that needed special consideration rather than being grouped under the heading 'attitudes' in models such as the TPB. However, many of these attitudes could be grouped with the unspecific measurement of

benefits and barriers reported in a number of studies. Concerns were consistently identified in all aspects of this review to relate to vaccination non-receipt including general concerns, concerns about safety, concerns about efficacy and concerns about the effect of the HPV vaccination on the sexual behaviour of adolescents. These concerns were evident in a number of countries and frequently cited. Concern about sexual behaviour was only raised in studies investigating non-receipt of HPV vaccination and not all childhood vaccinations suggesting that it is a specific concern to this particular vaccine. It is an issue that has only been raised since the development of this particular vaccine[6]. It was deemed to be influential in both qualitative and quantitative studies, suggesting that it is a novel issue that deserves further enquiry. Studies that investigated HPV vaccination intentions also found participants who did not believe vaccinations to be important were more likely to intend to refuse the vaccine highlighted, the importance of fear of needles and lack of trust in vaccination authorities/pharmaceutical companies. The fact that these three issues were not found to be associated with vaccination non-receipt in other aspects of this review suggests that they may only be important in informing vaccination intentions but are not significant enough reasons to actually refuse vaccination.

Social cognition model factors and knowledge

Perceptions of susceptibility were highlighted in every aspect of this review to be associated with vaccination non-receipt (actual non-receipt, intentions to refuse, qualitative reasons for non-receipt and in the findings of previous reviews) although the strength of the evidence was weaker for actual non-receipt as few studies had considered this factor. Perceptions of susceptibility or invulnerability are suggested by both the HBM (Becker et al., 1977; Rosenstock, 1966) and PMT (Rogers, 1975; 1983) to be important in determining whether a behaviour is engaged in and this appears to be the case for vaccination. Normative beliefs, considered in the TPB (Ajzen, 1985; Ajzen, 1988; Ajzen, 1991), emerged from all aspects of the review to influence vaccination uptake. Barriers versus benefits or negative vaccination beliefs were identified as being associated with intentions

[6] Previously vaccination against Hepatitis b (an STI) for adolescents has been trialed in one Scottish city. However, this pilot implementation was not accompanied with the mass media advertising and commentary that has been the case for HPV vaccination. This is likely to mean that parents offered Hepatitis b vaccination for their children were less likely to be engaged with the vaccination programme and the sexually transmitted nature of the vaccine than those parents offered HPV vaccination for their daughters.

not to receive a vaccination (although this was not the case for actual vaccination non-receipt). These beliefs or attitudes are theorised to determine behaviour in a number of social cognition models, although this may not actually be the case for vaccination. Perceived severity and self-efficacy were highlighted in the review of existing reviews to be influential in informing vaccination non-receipt but this was not the case for the present review. Perceptions of severity were considered in a number of studies for the present review and the lack of evidence that it is important suggests that it is no longer prominent in vaccination non-receipt. Few studies reported findings for self-efficacy and so its lack of influence in the present review was due to a failure of studies to measure the construct rather than it not being important.

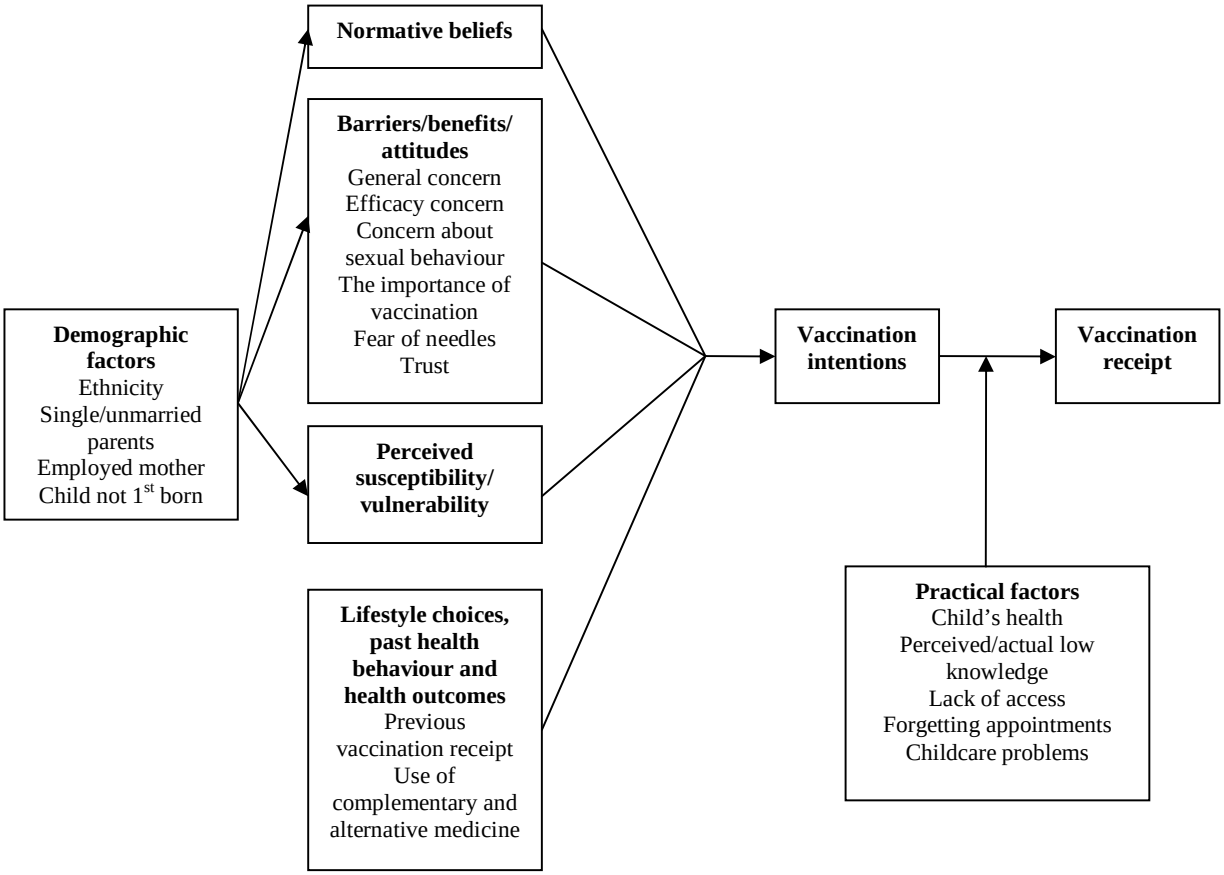
Intentions to refuse vaccinations and the summary of existing reviews found lower knowledge to be associated with non-receipt, but this was not the case when participants reported the reason for their non-receipt/intention to refuse vaccination or when examining actual vaccination non-receipt. This discrepancy may be because knowledge is considered important when thinking about vaccination hypothetically, but in reality lack of knowledge or having high knowledge does not prevent vaccination. The existing reviews are likely to have considered studies that were conducted prior to the introduction of the HPV vaccine and if this were the case the reviews are more likely to have explored studies considering existing early childhood vaccinations than HPV. It is possible that knowledge of these vaccines was more variable than knowledge of a new vaccine where only a rare minority have any prior understanding (HPV vaccination) and this would have allowed for greater variability in the data and made significant effects easier to detect (i.e. there is a greater likelihood that some participants had high knowledge as well as others having low knowledge). The implication of this is that HPV vaccination knowledge may become a more influential factor on vaccination non-receipt as the vaccine becomes more established and there are more opportunities to gain knowledge. Perceptions of low knowledge and a desire for more information were found to be influential in actual vaccination receipt and in the reasons given to explain vaccination non-receipt suggesting that perceptions of low knowledge are more associated with vaccination than actual knowledge. Parents who sought more information were less likely to have vaccinated their children but this was most likely because these parents have an existing uncertainty about a particular vaccine

and so have sought more information than the average parent who does not share these concerns, rather than it being that greater knowledge per se equaling greater non-receipt.

How might these factors work together to affect vaccination non-receipt?

As multiple-variable studies were not considered in this review it may be important to contemplate how the factors identified to be important in this review collectively influence vaccination non-receipt and the pathways through which they work. The social cognition models described in the introduction and Sturm et al's (2005) model of parental vaccination decision making (described in the summary of reviews) provide a useful structure to work with, with the addition of other factors identified to be influential in this review. Using the evidence described in this review a model to explain vaccination non-receipt has been proposed. As illustrated in Figure 2.4 demographic factors may influence social cognition model variables of barriers/benefits or attitudes (from the HBM and TPB respectively), perceived susceptibility/vulnerability (from the HBM and PMT) as proposed in the HBM and normative beliefs (from TPB). The practical factors would most likely affect the relationship between intentions and behaviour, although intuitively perceived/actual low knowledge within this factor may also affect perceived susceptibility and barriers/benefits/attitudes independently (not included in the diagram). There was no evidence in this review for the role of the factors that the TPB suggests informs subjective norms. Social cognition model factors inform vaccination intentions, as do lifestyle choice, past health behaviour and health outcome factors. There was not evidence in the present review to suggest that the social cognition model components impact on behaviour/intentions through self-efficacy as proposed by the HBM. Although there was no support for the role of intentions in the present review, in accordance with the TPB and PMT, intentions are likely to inform behaviour.

Figure 2.4: Proposed model to explain vaccination non-receipt using the evidence from this review.



A relevant systematic review was published after the final search was conducted, but the topic and findings were pertinent to the present review and so are briefly discussed below (Brown et al., 2010). The review considered the factors that are related to whether parents allow their child to receive the first dose of combination vaccinations offered in childhood in developed countries and included studies published from 1987-2008. The majority of the 31 empirical studies considered in the review were conducted in the UK and Ireland, sampled mothers and used unrepresentative samples. In agreement with the present review they found the methodological quality of the studies to be mediocre, calling into question the reliability of the findings and criticised the use of non-objective measures of vaccination receipt and retrospective methods. Similarly to the present review, parental attitudes about the safety and efficacy of combination vaccines were consistently associated with vaccination receipt and the authors also highlighted the importance of mistrust of government and healthcare professionals. There appeared to be a role for knowledge, source of information and satisfaction with information provision. Contrary to the present review they found that perceptions of disease severity were associated with uptake and their

qualitative findings suggested that parents dislike risking their child's health solely so that herd immunity is achieved. The authors found vaccine refusers to generally have lower incomes and levels of educational attainment and for the child to not be their first born. However, the review considered parental intentions to vaccinate their child against existing vaccines in addition to actual vaccination decisions, unlike the present review.

Limitations

The limitation that is of primary importance is the mediocre quality of the evidence to support the findings of this review. The majority of findings had an unclear risk of bias, for a number it was plausible that the finding was biased and in very few cases could it be certain that the findings were unlikely to change had the studies been replicated. The criteria used to judge the quality of the individual studies were stringent but included important methodological techniques that should ideally be used. A systematic review examining the measures used in 79 studies exploring HPV vaccine acceptability echoes the concerns of this review (Allen et al., 2010). The authors concluded that these studies are limited by being cross-sectional in design and failing to report reliability or validity statistics. Future research should consider performing prospective studies, that use objective measures of vaccination receipt, that have piloted their study, that report their methodology for qualitative analysis, that are sufficiently powered to detect small effect sizes and should dedicate considerable effort to ensure a high response rate.

The methodologies used by the studies considered in the review employed a variety of definitions of vaccination non-receipt which could have caused findings to vary. However on no occasion did the definition of vaccination non-receipt explain differences in findings (for example when significant and non-significant results were reported). In most cases vaccination status was elicited through self-report which as discussed in the methods section is liable to bias, although objective measures such as medical records are not perfect themselves, they are created with the intention of being a documentation of healthcare receipt (Harrington et al., 1995; Jefferies et al., 1991; Salmon et al., 2005; Wei et al., 2009). It is likely that there is a degree of measurement error in most of the studies considered in this review.

The populations considered in the studies included in this review were fairly homogenous and mainly used American participants, although the studies were performed in a large number of countries. The research was conducted with participants who were reasonably wealthy, with an average education and were predominantly white, suggesting that the findings are not a true reflection of whole populations. Ethnicity was not often reported and given that ethnicity appeared to be an important factor in vaccination non-receipt this is a limitation of current research. This can be easily rectified in future research. Fathers only were not considered in any study. This may reflect the fact that mothers are traditionally the primary caregiver for children and so are likely to be bringing them to clinics for vaccination, where recruitment for studies often occurred. However, this neglects that fathers will likely be involved in the vaccination decision making process and their opinions need considering. A crude estimate of the most common age of child was 11 years. This is likely a reflection of the large number of HPV studies included in the review raising the average age as few of the early childhood vaccination studies used participants who were that distal from vaccination receipt.

This review explored some studies that examined vaccination completion. Completion is likely to vary by vaccine type and number of doses needed and this level of detail was not considered in this review. As a consequence the findings of this review relating to vaccination completion specifically are unlikely to provide the level of detail needed to comprehensively understand vaccination completion; although this was not an aim of this review.

The findings of the review have a number of restrictions. Firstly, the approach was limited because effect sizes were not taken into consideration when interpreting the findings. For this reason we cannot know the importance of each factor in informing vaccination non-receipt. Similarly, the number of participants in each study was not considered. It is possible that evidence for a factor suggesting a positive relationship may have been based on a small cumulative sample size and that the one study reporting non-significant findings for this factor was ignored even though it could have been based on a very large study. It may have been the case that the factors outlined in the proposed model to explain

vaccination non-receipt all made very small contributions to vaccination decision making, whereas factors that were not found to significantly relate to vaccination decision making had large effect sizes but were not powered sufficiently for them to be detected. It may have been more appropriate for a meta-analysis to have been performed instead of a systematic review as such reviews do take into consideration effect size and sample size. A meta-analysis was not conducted as means and standard deviations were not consistently reported in the articles included in the review. Given the time limited nature of this review (conducted as part of a PhD) it was not feasible to contact all of the authors of the articles that were included in the review. However, it must be acknowledged that the findings may have changed had a meta-analysis been performed.

The review considered univariate results only; because of this the complex relationships between factors that are associated with vaccination compliance were not explored. The grey and unpublished literature was not formally sought out during the literature search meaning that publication bias may have influenced the findings of the review. Additionally, I did not contact the authors of the studies to obtain missing data because, as described above, the review was time limited and had to be completed quickly. It would have taken a considerable amount of time to contact all the authors of studies that reported multi-variable findings and for them to respond with the relevant information. However, this does mean that data were not included in the review that had the potential to be publically accessible, which limits the accuracy of the findings of the studies.

The studies considered were limited to childhood vaccination programmes in developed countries and to studies published in English language journals. It is likely that relevant articles that were not published in English but were conducted in developed countries were omitted from this review. Vaccination non-receipt in developing countries is likely to differ from developed countries because of socio-economic and cultural variations between individuals and healthcare systems. The total sample sizes reported were used to assess quality and it is likely that the actual sample sizes used for some statistical tests may have been smaller than those used in this review for power calculations. As a result some quality assessment points may have been awarded unjustifiably. This review did not assess studies

that examined parents of sons[7] only or boys only, nor did it assess studies that asked adults to respond for a hypothetical child. Parents' acceptance of the vaccine for a son could be different from acceptance for a daughter especially considering that males will not necessarily benefit from receiving a vaccine primarily targeting cervical cancer. Furthermore, hypothetical responses (for a son or in adults without children) will be less useful in explaining how parents will respond and may even confuse the picture for studies examining parents of vaccine-eligible daughters. The review did not consider hypothetical STI vaccines other than the HPV vaccine. Acceptance of other STI vaccines is likely to differ as the HPV vaccine is being promoted as a vaccine against cervical cancer whereas STI vaccines will primarily be endorsed for their benefits against STIs. HPV vaccines have also received a lot of media and advertising attention since their licensing (2007) that other undeveloped STI vaccines have not, and this will have influenced knowledge and acceptance of the HPV vaccine and allowed individuals to have formed opinions. Finally, only one coder extracted the data, meaning that data extraction could have been coder-biased. However, I did double enter the extracted data which would have reduced the likelihood of basic errors in data extraction occurring.

Conclusions

This review identified a number of factors that are potentially important in influencing vaccination non-receipt, although the quality of the evidence overall provided an unclear risk of bias so the findings should be interpreted with caution. Social cognition model factors of subjective norm, perceived susceptibility and benefits versus barriers or attitudes (particularly specific and general concerns) seem to influence non-receipt, as do practical factors, lifestyle choices, past health behaviours and health outcomes, and some demographic characteristics. A model to explain vaccination non-receipt using the current evidence was proposed that was adapted from social cognition models and an existing model of parental vaccination decision making. Future research should consider using more objective measures of vaccination receipt, it should consistently report ethnicity and

[7] It has never been intended that males should receive the HPV vaccine as part of the UK childhood immunisation schedule.

should consider examining fathers only, individuals of a low SES and more heterogeneous populations that are not solely white.

OBJECTIVES FOR THIS THESIS

The HPV vaccination for the prevention of cervical cancer has the potential to reduce incidence of cervical cancer. However, as identified in Chapter 1, a significant minority of girls in the main UK HPV vaccination programme did not receive the HPV vaccine during the first year of the programme, and the majority of girls who were eligible for vaccination as part of the 'catch-up' programme remained unvaccinated. This literature review identified the possibility that concern about girls' sexual behaviour following HPV vaccination may influence parents' HPV vaccination decisions and, with the addition of other known predictors of HPV vaccination uptake, could explain why some girls are not receiving the HPV vaccine. Given the relationship between HPV infection and sexual activity this issue is specific to HPV vaccination (unlike other communicable diseases that vaccines prevent) and has not been considered in the wider vaccination literature. As a result, this aspect of HPV vaccination decision making and parental unease about a vaccination relating to sexual behaviour being offered in early adolescence, has not been considered in detail in previous research, although both quantitative and qualitative research have shown it to be important in influencing vaccination decision making. As the case with the MMR vaccine has highlighted, single issues can override parents' beliefs about the benefits of vaccination and determine vaccination choices. The media played a role in the MMR controversy and it is highly likely that the development of a cancer preventing vaccine will receive substantial news coverage. As a result, it will be important to monitor media coverage of the vaccine. With a greater understanding of parents' concern about girls' sexual behaviour following HPV vaccination, it may be possible to alleviate these apprehensions by appropriately engaging with parents to reassure or address their anxieties. This can be achieved by speaking to parents themselves as we will be able to understand their concerns more clearly. It will also be important to investigate what effect adolescent girls believe the vaccine will have on their sexual behaviour and for sexual behaviour to be monitored when the vaccine has been received or offered.

Accordingly, the objective of this thesis was to explore parents' concerns about sexual behaviour in their daughters following HPV vaccination in the context of the UK HPV immunisation programme and examine whether these concerns were justifiable. The thesis had four specific aims:

1. To explore whether the issue of girls engaging in increased risky sexual behaviour following HPV vaccination is being addressed in the UK national press.
2. To establish the degree of concern that parents feel about HPV vaccination and sexual behaviour.
3. To establish girls' views on HPV vaccination and sexual behaviour.
4. To examine the effect of participation in the HPV immunisation programme on sexual behaviour in older girls participating in the 'catch-up' programme.

Chapter 3 – The theoretical and empirical evidence for adolescents engaging in risky sexual behaviour following HPV vaccination.

The review of the literature in Chapter 2 revealed that parents have shown concern about their children's sexual behaviour following HPV vaccination. These concerns fall into two groups. Firstly parents have expressed apprehension that girls will engage in more risky sexual behaviour following HPV vaccination because they believe that they have a reduced risk of catching an STI after receiving the vaccine; for example increasingly engaging in unprotected sex or having sex more often, at an earlier age and with a greater number of partners (for example, Marlow et al., 2007a; Ogilvie et al., 2007; Woodhall et al., 2007). The second type of concern expressed by parents is concern that HPV vaccination consent implicitly confers *'carte blanche'* approval for sexual activity in their daughters (for example, Bair et al., 2008; Constantine & Jerman, 2007; Waller et al., 2006). The prevalence and specific nature of these concerns are discussed in detail in Chapter 5 and Chapter 6. Theoretical understanding of risk and evidence from similar contexts can be useful in attempting to predict and understand girls' sexual behaviour, and specific to this situation, theories of risk perception from health psychology and economics may help investigate parents' concerns. It cannot be known whether sexual behaviour has actually changed until the vaccination programme is established. However, it would not be unreasonable to consider that protection from an STI may lower risk perceptions and ultimately influence the adoption of safe sexual behaviours. Alternatively, it could be the case that HPV vaccination results in increased perceptions of risk, leading to the adoption of safer sexual behaviour. Short et al. (2010) interviewed older adult women about their attitudes to their receiving the HPV vaccine. Some women thought that they might engage in safer sexual behaviour as HPV vaccination would act as reminder of the risks of having sex: *"... like letting you know it's a caution out there. So I would use a condom just in case"*. In the absence of evidence of actual behaviour change of any kind following HPV vaccination, the theoretical background of the concern about risky behaviours expressed by parents was examined in this chapter.

PERCEIVED RISK

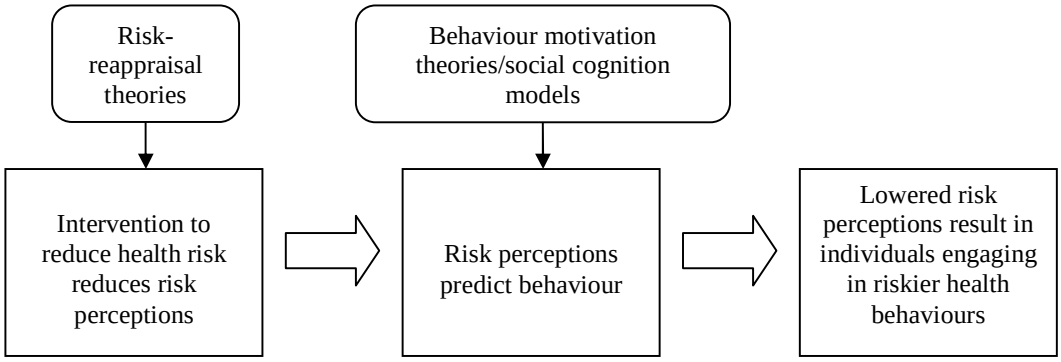
Perceived risk is an individual's 'perceived probability that harm will occur if no action is taken' and is also known as perceived likelihood, perceived susceptibility and perceived vulnerability (Weinstein, 2000). Many academic disciplines have considered risk perceptions and identified a number of factors that are important in predicting perceived risk. Economic theories of risk compensation (Wilde, 1976) suggest that perceived risk is predicted by past experience and the causal attributions that have been afforded to past outcomes. The economic interpretations of perceived risk will be discussed in more detail below. Psychological theories emphasise the importance of both experiential and rational systems in the construction of risk perceptions (Reventlow et al., 2001). Heuristics such as optimistic biases (Weinstein, 1987) and affect such as dread (Fischhoff et al., 1978) both influence perceptions of risk. The anthropologic Cultural Theory (Douglas & Wildavsky, 1982) proposes that cultural adherence and social norms affect risk perceptions, and the Social Amplification of Risk Framework (Kasperson et al., 1988) suggests that the way a risk event is communicated amplifies or attenuates the receiver's risk perceptions.

THEORIES OF RISK PERCEPTION AND BEHAVIOUR CHANGE FROM HEALTH PSYCHOLOGY

Perceptions of risk are identified as contributing components of many theories of health behaviour and are deemed to be the "motivational engine" behind many health protective behaviours (Robb et al., 2007). Social cognition models including the Health Belief Model (Becker, 1974; Rosenstock, 1966), Protection Motivation Theory (Rogers, 1983) and Health Action Process Approach (Schwarzer, 1992; Schwarzer, 2001) all posit that perceived vulnerability or susceptibility to an illness predict behavioural intentions and behavioural intentions themselves are associated with actual behaviour (Conner & Sparks, 2005). Behaviour motivation theories solely specify that perceptions of personal risk predict behaviour (Brewer et al., 2004). Risk-reappraisal theories (also termed adaptive accuracy; Renner et al., 2008) suggest that when actions are taken that are thought to effectively control or increase risk, individuals' perceptions of risk adapt to reflect this change (Brewer et al., 2004). Figure 3.1 is a diagrammatical representation of how these theories work together to help explain risky health behaviour following an illness-prevention intervention. In the context of HPV vaccination the theories would suggest that

HPV vaccination (the intervention) causes girls to perceive their risk of an STI to have lowered; these reduced risk perceptions predict the girls' subsequent behaviour resulting in them engaging in riskier sexual behaviour.

Figure 3.1 - The relationship between risk perceptions and behaviour



Evidence for the theory

Although there is a wealth of research investigating the role of risk perceptions in explaining behaviour, research examining the notion that risk perceptions change in response to an intervention and then predicting future behaviour is limited. There is evidence that after the adoption of an illness prevention intervention, individuals' perceptions of risk reduce but it is unknown whether this will be the case with HPV vaccination. Brewer, Cuite, Herrington and Weinstein (2007b) studied Lyme disease protective behaviours following Lyme disease vaccination (a vaccine that reduces but does not eliminate the risk of disease). They found perceptions of risk to have lowered in the vaccinated group (below the levels of the unvaccinated group; risk-reappraisal). Individuals who had been vaccinated (a group that had been shown to have lowered risk perceptions) were found to perform two of five Lyme disease protective behaviours less often than before their vaccination (using tick repellent and wearing light-coloured clothing; behaviour motivation).

ECONOMIC THEORIES OF RISK PERCEPTION AND BEHAVIOUR CHANGE

Risk compensation, a term first coined by Wilde (1976), grew out of economic theories and encompasses both risk-reappraisal and behaviour motivation theories but also attempts to explain the flux in risk perceptions and behaviour. It has mainly been investigated in the field of safety, specifically traffic safety.

Inherent in risk compensation theories is the premise that individuals attempt to maximise the benefits and minimise the personal risks of engaging in an activity. In order to acquire benefits of an activity, individuals accept a certain level of personal risk. If personal risk is perceived to have changed, individuals will adjust their activity to readdress the benefits-risk balance (this is risk-compensation). Various versions of risk compensation have been proposed including Peltzman's (1975) Economic Model of Human Behaviour and Human Behaviour Feedback Theory (Evans, 1985). Three varying models of risk compensation will be introduced below: Risk Homeostasis (Wilde, 1982), Danger Compensation (O'Neill, 1977) and Risk Thermostat (Adams, 1985; Adams, 1988). A summary of the evidence for these theories has been provided.

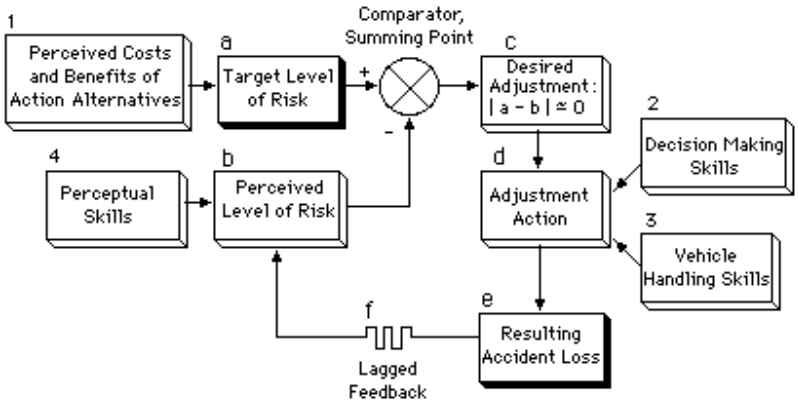
Risk Homeostasis (Wilde, 1982)

Wilde (1982) proposed a physiologically-based version of risk compensation based on driving behaviour which he termed Risk Homeostasis (Figure 3.2). The theory proposes that individuals have a target level of risk that they base on a balance between the perceived costs and benefits of action or inaction. An individual's evaluation of what costs they are willing to accept and what benefits they desire is defined by the level of physiological arousal that they perceive to be optimal (Simonet & Wilde, 1997). Perceptions of risk arise from the individual's evaluation of previous action and their knowledge of others' experiences (Wilde, 2002). Individuals attempt to maintain physiological and psychological equilibrium between perceived risk and target risk: if their perceived risk in a situation exceeds their target level of risk they will act to reduce their risk and if their perceived risk is lower than their target level of risk they will increase their risk through more dangerous actions.

Wilde argues that safety interventions, such as the implementation of seatbelts will not ultimately result in fewer accidents; although seatbelts may cause an immediate decrease in mortality from road accidents, after a lag-time (where new risk information is fed-back and interpreted, such as media reports that the roads are now safer), the number of negative events will return to normal as individuals may now perceive that they can now drive more quickly to compensate for the safety provided by seatbelts (the evidence for this is discussed in the next section). Only safety strategies that influence the target level of risk will ultimately reduce the number of occurrences of an undesired outcome because it will mean that individuals are unwilling to accept a higher level of risk (Simonet & Wilde, 1997).

This theory has been criticised for assuming that individuals are able to rationally adjust their behaviour on a moment-by-moment basis (Robertson & Pless, 2002) and for suggesting that Risk Homeostasis occurs for all behaviours and in all situations (O'Neill & Williams, 1998).

Figure 3.2 - Risk Homeostasis in driving behaviour (Wilde, 1982)



Danger Compensation (O'Neill, 1977)

Danger Compensation theory approaches risk compensation from a theoretically distinct standpoint: expectancy theories. O'Neill supposes that individuals are rational beings with stable goals. They adjust their behaviour in an attempt to maximise the extent that outcomes reflect these goals and minimise risk (the motivation for behaviour is the maximisation of goals, rather than maintaining target risk). Safety changes to an environment will not result in improved safety rates because after an undefined period of time accident rates will return to a 'normal' level due to individuals adjusting their behaviour to compensate exactly for the safety changes in their environment that have allowed them to further maximise their goals.

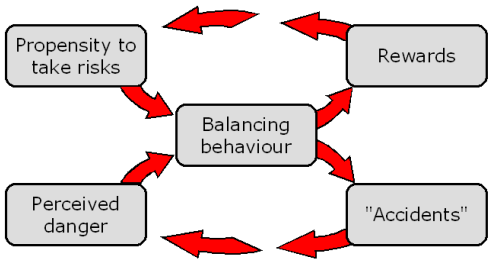
The theory was designed to explain driving behaviour, but it is proposed that it could be applied to any regularly performed behaviour enacted to achieve a goal at the risk of a rare event. O'Neill concedes that aspects of Danger Compensation may not always hold true in reality, such as individuals being accurate at estimating their own risk or being rational and that his approach is theoretical rather than descriptive.

Risk Thermostat (Adams, 1985; Adams, 1988)

Adams' 'Risk Thermostat' (Figure 3.3) attempts to simplify Wilde's original model and proposes that risk compensation is conceptual (rather than operational as Wilde suggests). Similarly to Wilde, Adams suggests that everyone takes risks to a varying degree. Decisions to engage in a risky behaviour are based on a balancing act between perceived danger (perceptions of risk) and the individual's target level of risk (propensity to take risk). Personal propensity to take risks is based on the rewards the individual perceives will result from engaging in a particular behaviour. The perceived danger associated with engaging in a behaviour is influenced by prior experience (their own and others') of negative outcomes that have resulted from engaging in that behaviour ("accidents"). "Accidents"/rewards are further predicted by the consequences of engaging in the current behaviour. The example of having a suntan may make this theory clearer. An individual's sunbathing behaviour can be determined by their propensity to take risk and their perceived danger. This individual's propensity to take risks, for example staying in the sun, is

explained by their experience of the rewards that they perceive from having a suntan, such as thinking others look attractive or being previously told that they look healthy when they had a suntan. Their perceived danger is based on their experience of being sunburnt or seeing another person with sunburn (or "accidents"). The balance between the individual's desire to avoid sunburn and desire to look attractive or healthy will determine their sunbathing behaviour and the outcomes of their chosen behaviour will predict their future propensity to take risks and perceived danger.

Figure 3.3 - Risk Thermostat (Adams, 1985; Adams, 1988)



Risk Homeostasis and Danger Compensation are more rigid versions of risk compensation than Adams' Risk Thermostat. They may be more useful in helping to understand changes or stability in population behaviour following the implementation of a risk reducing/increasing strategy, rather than explaining individual responses to such schemes. Many authors interpret risk compensation theories in general terms; accepting that individuals offset their perceived reduction in risk rather than making changes that completely compensate for reductions in risk (for example, Brewer et al., 2007b; Pinkerton, 2001). Adopting such an interpretation of risk compensation allows the use of the theory in general terms (as opposed to specific and more restrictive theories of risk compensation). Taking this approach appears to be a more intuitive and overarching attempt to explain human risk taking, especially in the field of health behaviours.

A general interpretation of risk compensation can be applied to HPV vaccination and risky sexual behaviour. An adolescent girl could be motivated to not use condoms because of the embarrassment of discussing using them with her partner, but thinks she should use them to

avoid catching an STI. If following HPV vaccination, this girl perceives her risk of STIs to have been reduced, she can permit herself to engage in more unprotected sex without exceeding her risk threshold.

Evidence for risk compensation

No studies have examined risk compensation specifically in relation to HPV vaccination. Much of the evidence for the theory's development came from observational studies of traffic accidents following the implementation of enforced safety measures, such as wearing seat belts, although this research did not measure risk perceptions directly. Adams (2000, p.125) reported that the implementation of seat belt laws had no effect on total fatalities; although car occupants were less likely to die, pedestrians and cyclists were more at risk due to increases in risky driving by motorists. However other data has questioned such findings (Ferguson et al., 1995; Kahane, 1994; Kahane, 1996; Lund & Zador, 1984; Lund & Ferguson, 1995; O'Neill & Lund, 1993; Zador & Ciccone, 1993). Some studies have partially supported the theory, but the idea that original levels of risk are always restored is not consistently evident in the data. Peterson, Hoffer and Millner (1995) reported that there was an increase in the number of insurance claims following the adoption of airbags by drivers, but the increase did not diminish over time (as would be expected with restoration of original risk levels) and in the HIV prevention literature increases in condom use appeared to have coincided with an increase in the number of acts of intercourse but this overall rise did not increase HIV/STI risk (Pinkerton, 2001).

A more recent examination of risk compensation tested the theory more comprehensively by examining the role of risk perceptions. Brewer, Cuite, Herrington and Weinstein's (2007b) Lyme disease experiments provide partial support for risk compensation. As explained in the section exploring psychological theory of risk, Brewer et al. reported that risk perceptions reduced after vaccination and vaccinated individuals performed certain Lyme disease protective behaviours less frequently. Their data also showed that vaccinated individuals who perceived greater reductions in risk reduced the frequency with which they performed four Lyme disease protective behaviours more than vaccinated individuals who had smaller reductions in perceived risk. Furthermore, individuals who over time engaged

in fewer Lyme disease protective behaviours perceived their risk to have increased. However the notion of original levels of risk being restored was not supported by their data; more rigid interpretations of the theory would predict that vaccinated individuals (who should have had a perceived reduction in risk) who engaged in fewer protective behaviours (and so should have had a perceived increase in risk) would show no change in risk perceptions, but this interaction was not confirmed by the data.

It appears then that partial support for the theory is evident, namely that safety interventions can result in individuals increasing their risky behaviour. However, the notion of original levels of risk being restored is not often supported by the data. This further supports a more general interpretation of the theory. There are also methodological problems with most existing risk compensation studies as they have not assessed perceived risk, arguably the most important aspect of the theory.

Limitations of applying risk compensation theories to the context of HPV vaccination

There is reason to believe that risk compensation will not be evident in the context of HPV vaccination. Theoretical caveats to the idea that girls will engage in risky sexual behaviour following HPV vaccination are described by Hedlund (2000). Hedlund suggests that risk compensation will only occur under certain conditions: those in which the protective behaviour is perceived to be effective, when the protective behaviour is visible, when the individual is motivated to change their current behaviour, and when the individual has control over their current behaviour. It is unknown whether adolescent girls will remember that they have received the vaccine when engaging in sexual activity, whether they are motivated to engage in sexual behaviours more frequently or without protection, and whether they believe that they have self-efficacy in their sexual behaviours. Nor is it known how effective girls perceive the vaccine to be (and the impact of this on their risk perceptions) and this in itself is dependent on a complex interplay of a multitude of factors identified at the beginning of this chapter. Unlike other health behaviours such as exercise and dental hygiene, risky sexual behaviours are dependent on the behaviour of two people and consequently the interaction of two individuals' perceptions of risk must be taken into account. The beliefs of others who are equally affected by the risk behaviour are not

considered by theories of risk compensation, although they are likely to be hugely important in the context of sexual behaviour. Even if the criteria for risk compensation were fulfilled in girls who receive the HPV vaccine, boys are currently not offered the vaccine in the UK and so their risk perceptions may not change in accordance with the theories unless they see the girl as a less risky partner.

Evidence of behaviour change in other STI reduction interventions

As there is not yet any evidence of the effect of HPV vaccination on behaviour change, it is important to consider whether there is any evidence of behavioural alterations following other STI reduction interventions. Some research, although not specifically testing risk compensation has shown undesirable changes in behaviour following such interventions. These studies have not examined whether risk perceptions mediate behaviour change or whether original levels of risk are ultimately restored and were designed to establish the efficacy of the intervention in STI reduction rather than exploring the effect of the intervention on changes in sexual behaviour. Nevertheless they do provide an indication of how individuals respond to sexual health interventions that reduce the risk of STI acquisition.

Circumcision has been used as an intervention to reduce HIV and STI transmission. It has been shown to reduce HIV transmission in South Africa, Kenya and Uganda by up to 60% (Auvert et al., 2005; Bailey et al., 2007; Gray et al., 2007). Auvert et al. (2005) reported that following circumcision, males had more sexual partners than non-circumcised males (although no differences were found for condom usage). Similarly, Gray et al. (2007) found that six months after circumcision males reported more inconsistent condom use and were less likely to use condoms than non-circumcised males, although these differences were not present at 12 or 24 month follow-up and the authors did not make it clear whether condom use differed from baseline reports. Bartholow et al. (2005) studied male participants in an HIV vaccine trial who reported having sex with men and although they found an overall decrease in instances of unprotected anal sex, those who believed that they were allocated to the experimental arm (although they were blind to their allocation) reported an increase in their instances of unprotected anal sex. However two trials of male

circumcision found no differences in sexual behaviour between circumcised and non-circumcised males (Agot et al., 2007; Wawer et al., 2009) and another found in absolute terms, males to report more consistent condom use, a reduction in instances of unprotected sex and to make fewer reports of two or more partners in the previous six months than before their circumcision (Bailey et al., 2007). The participants in these studies knew that they were involved in HIV risk reduction trials although none of the authors explicitly stated whether participants knew how much their risk had been reduced by.

Finally, there is some weak evidence that sexually transmitted infection vaccinations already in use do not negatively influence sexual behaviour. Ogilvie, Anderson, Marra McNeil and Pielak et al. (2010) reported that increases in the average age of sexual debut for adolescents in British Columbia, detailed in Saewyc, Taylor, Homma and Ogilvie (2008), occurred at the same time that Hepatitis B vaccination for 11 year olds was introduced into a school-based immunisation programme. However, the original authors did not suggest that the introduction of the programme influenced the improvements in sexual behaviour nor was the vaccine considered in any of their primary analysis.

Limitations of applying evidence from existing STI reduction interventions to the context of HPV vaccination

Methodological issues may limit the relevance of evidence from existing STI reduction interventions to the context of HPV vaccination. Firstly, the studies described mainly used male populations, most of which were from Africa. Cultural and gender differences may restrict the relevance of these studies to British girls receiving the HPV vaccination. Furthermore, some of the interventions were much more invasive than HPV vaccination and the participants' involvement in a substantial clinical trial is likely to have influenced not only the attitudes and behaviours of the participants, but of their sexual partners also.

Secondly, in comparison to HIV, knowledge about HPV is low, especially its link to sexual behaviour. Prior to the development of the vaccine the percentage of young women who knew that HPV was the cause of cervical cancer was sometimes reported to be as low as 8% (Klug et al., 2008) and the UK government are promoting the vaccine as a cervical

cancer prevention method rather than as protecting against an STI. Consequently, girls may not even associate the vaccine with sex, although the HPV vaccination information leaflet aimed at older girls does reference the sexually transmitted nature of HPV. Even if knowledge improves, there is a complex interplay of factors that affect sexual behaviour that shall be discussed in detail in Chapter 7. For example, fear of pregnancy or other STIs (that the vaccine does not protect against) are commonly reported reasons for remaining abstinent in young women (Blinn-Pike, 1999; Morrison-Beedy et al., 2008). Finally, risk theories ignore the emotional aspects of initiating a sexual relationship with another person.

SUMMARY OF CHAPTER 3

Until the HPV vaccination programme is established it will remain unknown whether parents are right to be concerned that their daughters are likely to engage in more risky sexual behaviour following HPV vaccination. Theories of risk perception from health psychology and economics and evidence from comparable contexts to HPV vaccination can help predict whether behaviour change is likely. Although the importance of perceived risk in health behaviour research is recognised, there is very little health psychology research examining alterations in perceived risk and subsequent behaviour change. General interpretations of economic theories provide a useful structure to examine such events but again little research has employed the constructs appropriately. There are also other theoretical caveats that limit the theory's relevance to HPV vaccination. Some evidence from STI reduction interventions suggest that sexual behaviour may change but their relevance to the HPV vaccine is questionable. Taking these caveats into account it appears unlikely that girls will engage in more risky sexual behaviour following HPV vaccination, but given mothers' concerns it is important to investigate further. Risk compensatory behaviour is only likely if certain criteria are fulfilled: the intervention needs to be visible and perceived to be effective, the individual must have control over their behaviour and be motivated to change. In addition for behaviour change to be likely, young women are going to have to misinterpret the protection afforded by the vaccine to include all STIs and is more likely to cause young women to reduce their condom usage or increase their number of sexual partners if they are sexually active prior to vaccination (rather than virgins initiating sexual relationships).

Even though behaviour change will be unlikely in most girls, theoretically behaviour change is possible in a minority of cases. Risk theories may not prove applicable to HPV vaccination, but their constructs and proposed pathways will be useful in determining what should be measured and how analysis should be conducted. Even if no girls change their behaviour following vaccination, as detailed in Chapter 2, some parents would withhold consent to HPV vaccination for this reason. Demonstrating that behaviour does not change may help alter these parents' beliefs.

Chapter 4 – An analysis of newspaper articles about the HPV vaccine and risky sexual behaviour

BACKGROUND[8]

Chapter 2 identified that parental concern about risky sexual behaviour in girls following HPV vaccination has been addressed in the academic literature. Given the newsworthiness of the development of a vaccine to prevent a cancer, the HPV vaccine has received significant coverage by the mass media and the issue of adolescent sexual behaviour in the context of the vaccine was mentioned. The public consider the media to be a useful source of information about HPV and it has the potential to affect perceptions of health issues (Lupton, 1998; Pitts et al., 2007). News articles often try to provide a 'balanced' discussion of current affairs (even if the alternative view is only endorsed by a minority), in an attempt to indicate that competing arguments exist (Hargreaves et al., 2003) and commentary articles can also assert controversial opinion to stimulate debate. Both types of article provide opportunities for anti-vaccination groups and beliefs to be represented. Experience in the UK of other vaccines, notably those against pertussis and MMR, shows that media reporting of vaccine safety issues can hugely influence public perceptions and vaccine uptake (Griffith, 1981; Hackett, 2008). The sexually transmitted nature of HPV will likely generate significant media coverage and public debate, and coupled with the unease that has accompanied the use of previous vaccines, this may affect parents' vaccination decisions.

Little is known about the content of the British media coverage that the HPV vaccine has received. Quilliam (2006) reviewed 11 HPV vaccination stories in British newspapers and British news websites after the announcement that the vaccine had been developed. Five of these reports were predominantly positive, and stories that criticised the vaccine tended to

[8] This study was conducted between December 2007 and June 2008. Literature available during this period which contributed to the rationale for this study has been presented in the introduction. Literature published after analysis had been performed has been introduced in the discussion section. A version of this chapter has been published in the Journal of Health Communication (Appendix 5).

have only a single sentence of negative commentary. Only one article was completely disparaging. Greene and Davies (2008) reporting a preliminary analysis found British print and electronic media coverage about the HPV vaccine to be dominated by articles detailing a moral panic regarding vaccination against an STI but the stories did not reflect traditional anti-vaccination discourse. Systematic analyses of newspaper and television news stories about HPV in the American media have been conducted although are limited by reviewing articles published over a short period of time (Ache & Wallace, 2008; Anhang et al., 2004a; Calloway et al., 2006), and either prior to the vaccine being recommended for use by the American government or not long afterwards. These studies found that information provided about HPV was not always accurate, often failing to include the basic facts that women generally want to know, such as information about transmission (Anhang et al., 2004a; Calloway et al., 2006), and they mainly quoted vaccine manufacturers or scientists (Calloway et al., 2006). One analysis of HPV vaccination videos posted on the internet found that the content was mainly positive (Ache & Wallace, 2008), although a proportion of these videos are likely to have been funded or created by the pharmaceutical industry. Calloway et al (2006) found 24% (n=6) of the American articles they analysed discussed parental concerns about adolescent sexual behaviour following vaccination, however the specific details of such discussions have not been evaluated in the scientific literature.

As has been the case with other vaccines previously, British media coverage of the HPV vaccine is likely to influence public awareness of the immunisation programme and perceptions of whether others are choosing to receive the vaccine or providing consent for their daughters to do so. Previous examinations of newspaper coverage of the HPV vaccine have mainly considered the American press. The findings of international studies, although useful to our general understanding of such issues, are likely to have been dependent on culture-specific beliefs and the unique immunisation programmes of these countries so their findings are less relevant to the discussions that are being reported in the UK. British analyses of media coverage have reported incomplete findings or have taken an unsystematic approach to their analysis. No study has explored in detail the impact that the sexually transmitted nature of this particular vaccine has had on media coverage. Public discussions of girls engaging in risky sexual behaviour may shape parents' beliefs about the matter. It is important to establish the nature of such stories to identify whether these issues

are likely to become barriers to parents consenting to HPV vaccination, particularly as health psychology theory suggests that potential barriers determine vaccination uptake (Becker et al., 1977; Rosenstock, 1966).

The present study sought to address aim one of this thesis:

1. To explore whether the issue of girls engaging in increased risky sexual behaviour following HPV vaccination is being addressed in the UK national press.

British newspaper stories about the HPV vaccine published in the most highly read main national daily and Sunday papers were examined. Stories discussing the issue of girls engaging in risky sexual behaviour following HPV vaccination were analysed quantitatively and qualitatively. Articles were considered that were published over a five year period, going beyond the time that the vaccine was first licensed to provide a more up-to-date analysis than previously published research. Five study-specific research questions were posed:

1. How frequently is the HPV vaccine reported on in the news press?
2. What proportion of articles on the HPV vaccine mention risky sexual behaviour following vaccination?
3. Has the proportion of articles being published that discuss risky sexual behaviour following HPV vaccination changed over time?
4. What is the tone[9] of articles mentioning risky sexual behaviour following HPV vaccination?
5. What is the content of articles mentioning risky sexual behaviour following vaccination?

As the American press has discussed parents' concern about adolescents engaging in more risky sexual behaviour following HPV vaccination, it was hypothesised that this issue would also be discussed publicly in the British press. Given the findings of previous

[9] Tone was defined as 'supportive' (generally encouraging of the vaccine), 'neutral/balanced' (stating no or mixed opinions about the vaccine) or 'opposed' (generally critical of the vaccine).

literature about the vaccine generally, it was also expected that these reports would mostly be positive. Findings about the frequency of articles published and the content of these articles were not predicted.

METHODS

This study was retrospective, employing descriptive quantitative and qualitative methods to examine newspaper stories relating to the HPV vaccine and risky sexual behaviour. Ethical approval was not required for this study. The electronic database NexisUK was used to obtain the stories for analysis (Reed Elsevier Ltd, 2008). NexisUK is an online database of articles from over 12,500 international, national and regional news sources worldwide. Filters can be applied to the database so that searches are specific to a country, date or by newspaper type or name. It is used in a similar way to other literature databases such as Medline: the user searches for key words and any instance of their use in an article that is published in a newspaper within the search filters is shown in the results. The whole article that uses that key word can then be downloaded in full. The most highly read daily (N=11) and Sunday (N=10) newspapers in the UK were searched (based on Guardian circulation figures from December 2007; Guardian News and Media Limited, 2008a; Guardian News and Media Limited, 2008b; Table 4.1) over a five year period (February 2003 to February 2008). The search terms included “HPV OR human papillomavirus”; “cervical AND cancer”; “STD OR sexually transmitted disease AND vaccine” as well as common misspellings of these terms.

Table 4.1 - Newspapers evaluated in the study

Newspaper name grouped by newspaper type	No. of included articles	No. of articles that were predominantly…		
		Supportive	**Neutral /balanced**	**Opposed**
Tabloid newspapers				
The Sun	4	1	3	0
The Mirror	4	1	3	0
The Daily Star	0	0	0	0
The Daily Record	3	2	1	0
News of the World	1	1	0	0
Sunday Mirror	1	0	1	0
The People	0	0	0	0
The Daily Star Sunday	0	0	0	0
Middle-market newspapers				
The Daily Mail	24	4	21	1
The Daily Express	5	1	4	0
The Sunday Mail	0	0	0	0
The Sunday Express	2	0	1	1
Broadsheet newspapers				
The Daily Telegraph	13	3	8	2
The Times	7	4	3	0
The Financial Times	7	1	5	1
The Guardian	6	2	5	0
The Independent	4	1	4	0
The Sunday Times	3	0	3	0
The Sunday Telegraph	1	0	1	0
The Observer	2	0	2	0
The Independent on Sunday	1	0	1	0
Total	92	21	66	5

After reading the stories identified by the search to gain familiarity with them, inclusion and exclusion criteria were applied that had been developed through discussions with colleagues. All stories that in any way addressed the issue of girls engaging in risky sexual behaviour following HPV vaccination were included. Articles were included both if they suggested that sexual behaviour would change following vaccination, but also if they explicitly stated that is would not or made reference to the argument. Stories were excluded if they were duplicates, focused on the finances of pharmaceutical companies or if less than 100 words of the story related to the HPV vaccine. One story was removed because it was a biography of an immunologist. All other article types were included (e.g. letters, editorials) to achieve a more comprehensive understanding of the topic by accessing both news and comment. The inclusion criteria were applied to all the articles identified by

the author of this thesis and another rater read 20% of the stories to validate this process. The kappa was good (.73; Cohen, 1960) and percentage agreement was high (92%).

Analysis

For each article a number of characteristics were noted: the date of publication, type and name of newspaper, type of article, political stance and readership of the newspaper (according to the Newspaper Marketing Agency), whether a major news event about HPV occurred in the month the article was published and the percentage of words in the article that referred to risky sexual behaviour. For the quantitative analysis the number of articles published per month was plotted, the predominant topic of each story was established and the number of times each topic arose overall was summed.

Framework analysis was used to qualitatively organise the news articles and identify the categories that were arising from the data; it is a non-linear analytical method (Spencer et al., 2003). The categories that were identified were interpreted descriptively using methods employed in the analysis aspect of content analysis. Content analysis first emerged in the early 20th century from the human sciences. It allows the analyst to determine the frequency that categories occur as well as their content and context and is often used to analyse newspaper articles (Weber, 1990). Content analysis ultimately results in a counting exercise, which can make results less open to interpretation than other qualitative methods (Weber, 1990). This method was deemed most appropriate for analysis as there were a large number of articles to be examined and it was not the intention of the present study to explore implicit meaning within the articles, but to consider the overt messages that parents are being exposed to. The category counting associated with content analysis was also particularly useful for this longitudinal study as it could reveal change over time.

Framework analysis consists of five stages (Ritchie & Spencer, 2000, p.178) and these were adhered to in the present study (see Appendix 4 for an example of the framework analysis). The first stage is familiarisation. The analyst reads through the data, making notes on topics that arise. Secondly, a thematic framework is identified based on the notes made during familiarisation. This initial framework is large but is refined by the analyst

conceptualising the issues more comprehensibly and involves subjective judgements of the importance of the categories. Next the analyst indexes the original data by matching it to the categories in the thematic framework. The fourth stage is charting: each case is assigned one row and each category assigned a column, permitting comparisons between categories and cases. Examples of each category from each case are placed in the chart. The main characteristics of each case were also charted (date of publication, article type, newspaper name and type, readership and political stance of the newspaper, whether a major news event about HPV occurred in the month the article was published and whether the percentage of words referring to risky sexual behaviour in the article was above the median percentage for all included articles). Similarities were identified between initial categories; these categories were grouped together and labelled. The framework was then revised to ensure that it was appropriate for the data. The conceptual framework was constructed using Microsoft Office Excel (Microsoft Corporation, 2003). The final stage is mapping and a content analysis approach was taken here. The charted categories were examined to explore the content of the text within each category, when the categories occurred, their context and frequency of occurrence. This qualitative method draws meaning from the original data at all stages of analysis and the data is systematically processed. Throughout this whole process, personal memos were kept to remind the analyst of categories that were arising and links between categories. The raw data was regularly returned to to ensure that the data was being analysed in an appropriate context. Similarities within categories were examined, but data was also respected for its uniqueness and outliers were noted. The tone of each article was rated as either 'supportive' (generally encouraging of the vaccine), 'neutral/balanced' (stating no or mixed opinions about the vaccine) or 'opposed' (generally critical of the vaccine). This analysis was verified by other colleagues to ensure that it was warranted.

Functionally this method was intuitive: the coding was flexible and allowed easy retrieval of information both within and between cases. The process of charting was transparent allowing others to judge the reliability of the interpretation of the data. Code and retrieve methods such as framework analysis have been criticised for analysing the data outside of the context that it was written but the method does allow for more abstract interpretation of the data (Ritchie & Spencer, 2000).

The framework analysis revealed a number of themes that were present in the articles that did not relate to risky sexual behaviour. These additional themes did not relate to the aims of this chapter so have not been discussed in the results. A list of these other themes and their sub-themes can be found in Appendix 4.

My role in this study

The study was conceptualised and designed by myself in collaboration with my PhD supervisors Professor Jane Wardle and Dr Jo Waller. Professor Wardle, Dr Waller and my third supervisor Professor Judith Stephenson discussed the analysis of data with me to verify my interpretations and aided in the writing of this study for publication. Dr Waller performed one of the inter-rater assessments to validate the included studies and I performed the other. I performed all other aspects of this study described in the method section unaided.

RESULTS

Characteristics of the articles included

The initial search identified 539 stories: 81 were duplicates, 35 were financial articles, 84 contained fewer than 100 words about the HPV vaccine, 1 was a biography of an immunologist and 120 did not mention the HPV vaccine. Of the remaining 218 articles, 42% (n=92) referred to risky sexual behaviour (see Figure 4.1 for a plot of the annual figures). These 92 stories were included in the main analysis (Table 4.1). Articles came from daily and Sunday papers and from a mixture of 'tabloid' newspapers (focus on sensational stories and gossip), 'middle-market' newspapers (entertainment and some serious news coverage) and 'broadsheet' newspapers (more intellectual and in-depth in content). Three of the eight tabloid papers and one of the four middle market papers that were searched did not mention the issue of risky sexual behaviour following HPV vaccination at all, but it was referred to at least once in all of the broadsheet papers that were searched. No articles were published in 2008 that mentioned the issue of risky sexual behaviour following HPV vaccination so the remaining analysis only considered articles published between 2003 and 2007.

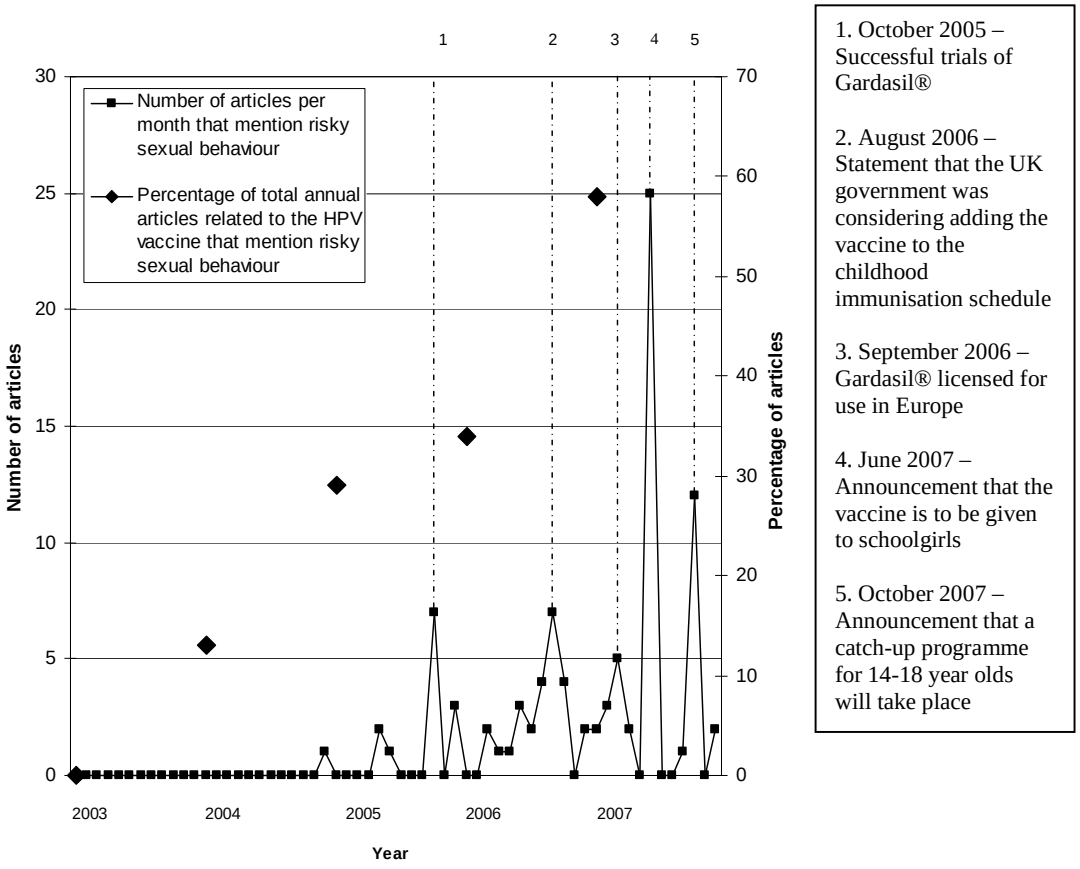
Quantitative analysis

The notion of increased risky sexual behaviour following HPV vaccination was not mentioned prior to December 2004, however, following this month the number of stories published per year increased steadily. Figure 4.1 shows five peaks in the number of articles published per month, corresponding to vaccine-related events:

- October 2005 – Successful trials of Gardasil®.
- August 2006 – Statement that the UK government was considering adding the vaccine to the childhood immunisation programme.
- September 2006 – Gardasil® licensed for use in Europe.
- June 2007 – Announcement that the vaccine is to be given to schoolgirls in the UK.
- October 2007 – Announcement that a 'catch-up' programme for 14-18 year olds will take place in the UK.

The proportion of articles about the HPV vaccine (total N=218) mentioning the idea of girls engaging in risky sexual behaviours following vaccination increased over time, from 0% in 2003 to 13% in 2004, 29% in 2005, 34% in 2006 and 58% in 2007 (Figure 4.1). In articles that mentioned the HPV vaccine, sexual behaviour was increasingly discussed during two months when vaccine-related events occurred. In August 2006, when the UK government announced that it was considering adding the HPV vaccine to the childhood immunisation programme, 100% of stories about the vaccine mentioned sexual behaviour. This figure was 81% for articles published in June 2007 when the government confirmed that the vaccine would be given to school girls.

Figure 4.1 – Number of stories that mention girls engaging in risky sexual behaviour following HPV vaccination



Only 5% of the 92 articles included in the final analysis were predominantly opposed to the vaccine (72% were neutral/balanced and 23% supportive). As a proportion of the number of articles mentioning risky sexual behaviour published per year, the number that were predominantly positive in tone decreased from 2005-2007 whereas the number of neutral/balanced articles fluctuated but remained fairly high (Table 4.2). Predominantly negative articles were only published in 2007 when the school immunisation programme was announced.

The Daily Mail and The Times published the highest number of predominantly supportive articles (both n=4; Table 4.1) and The Sunday Express and The Daily Telegraph published the highest number of predominantly negative articles (both n=2). The issue of girls engaging in risky sexual behaviour following vaccination was usually considered briefly and was the predominant theme of only 14% (n=13) of the stories. Unsurprisingly most

stories focused on explaining the vaccine and cervical cancer (35%) or the introduction of the vaccine (34%). Other themes arising from the stories included the pharmaceutical industry (4%), vaccination safety (3%), vaccination schemes in other countries (2%), STI rates (2%), calls to vaccinate boys (1%), the NHS (1%), personal experiences of cancer (1%), and sex before marriage (1%).

Table 4.2 – The tone of the articles published each year

Year	Number of articles mentioning risky sexual behaviour	Positive n (%[a])	Neutral/balanced n (%[a])	Negative n (%[a])
2003	0	0 (0)	0 (0)	0 (0)
2004	1	0 (0)	1 (100)	0 (0)
2005	12	5 (42)	7 (58)	0 (0)
2006	29	4 (21)	22 (79)	0 (0)
2007	50	12 (20)	36 (70)	5 (10)
Total	92	21 (23)	66 (72)	5 (5)

[a] Of annual articles mentioning the vaccine

Qualitative analysis

Discussions of adolescent sexual behaviour following HPV vaccination fell into three broad groups, although often the three types of discussion occurred within the same news story:

1. News stories proposing that girls will engage in risky sexual behaviour following HPV vaccination (mentioned in 60 of 92 articles).

2. Counter-arguments that girls will not engage in risky sexual behaviour after HPV vaccination (mentioned in 23 of 92 articles).

3. Parents' view of girls engaging in risky sexual behaviour following vaccination (mentioned in 12 of 92 articles).

Table 4.3 provides a summary of the content categories and the distribution of these categories by tone and newspaper type.

Table 4.3 – Content categories by tone and newspaper type

	Total n (%)	1. Behaviour will change n (%)	2. Behaviour will not change n (%)	3. Parents' views n (%)
Total	92 (100)	60 (65)	23 (25)	12 (13)
Newspaper type				
Tabloid	13 (12)	12 (20)	5 (22)	3 (25)
Middle market	33 (30)	29 (48)	5 (22)	2 (17)
Broadsheet	46 (42)	19 (32)	13 (57)	7 (58)
Tone				
Supportive	19 (23)	13 (22)	6 (26)	2 (17)
Neutral	66 (72)	42 (70)	17 (74)	9 (75)
Opposed	5 (5)	5 (8)	0 (0)	1 (8)

News stories proposing that girls will engage in risky sexual behaviour

Just under two thirds of all of the stories (56/92) provided some suggestion that the vaccine might encourage girls to engage in risky sexual behaviours, mentioning negative outcomes including teenage pregnancy, infertility, reduced condom use, increased STI rates, more promiscuity, and sex at a younger age. These claims were never substantiated with objective evidence. 'Groups' rather than individuals were referenced as criticising the vaccine on these grounds, and only four individuals were named and quoted, coming from religious and conservative family groups.

Critics said the jab, designed to be given before girls become sexually active, may promote sexual promiscuity (The Mirror 21/06/2007)

Conservative groups, including the influential Family Research Council (FRC), voiced strong concerns that immunising young girls against HPV may lead to sexual promiscuity (Daily Mail 16/04/2007)

A few stories (4/92) suggested why girls' sexual behaviour might change, such as girls believing that they are protected following vaccination and having reduced incentives to practise safe sex. One article merely stated that the vaccine will "trigger" unsafe sexual behaviour, without specific explanations. The language of the articles that raised the argument that girls will engage in risky sexual behaviour was sometimes emotive in nature and individuals were described as being fearful, panicked and anxious about the idea of the

HPV vaccine (19/92). Fear discourses were used to describe the possible changes in behaviour and their negative outcomes, making these changes and outcomes seem inevitable and out of control.

…if you vaccinate young women against a sexually transmitted disease, you are giving them a green light to become sexually active, plunging them into a dark, grown-up world for which they are not ready (Guardian 19/06/2007)

The proposal has alarmed some religious groups, which have argued that vaccinating girls will encourage them to start having sex at a younger age (The Express 24/04/2007)

Counter-arguments

Counter-arguments to the suggestion that girls will engage in risky sexual behaviours after HPV vaccination were not common (23/92) but several claims were made. Often these claims were made in articles that had also proposed that risky sexual behaviour will occur (15/23), suggesting that authors were attempting to provide a balanced discussion.

A popular rebuttal (7/92) was that the vaccine does not protect against other problems relating to unprotected sex and therefore there should be no change in sexual behaviour. Individual doctors or unspecified 'supporters of the vaccine' were quoted as being proponents of such views. Some of these articles (2/92) suggested that parents will attempt to reduce the likelihood of their daughters engaging in increased risky sexual behaviour by reminding them about pregnancy. Others (3/92) suggested that schoolgirls are already apprehensive about other STIs and this would prevent them from adopting more high-risk sexual behaviour.

Some stories (7/92) emphasised the lack of any evidence to support the argument that girls will engage in risky sexual behaviours following vaccination. Two of these stories quoted charities with an interest in the successful implementation of the immunisation programme as proponents of such views, such as Cancer Research UK. Spokespersons were quoted as stating that there was no evidence to support the critics' claims and provided comparisons

with other vaccines that are also related to sex (such as the rubella vaccine), noting that these vaccines did not cause any adverse effects on sexual behaviour. In addition, one feature article presented evidence suggesting that the vaccine will have the opposite effect on sexual behaviour due to the positive consequences of sex education.

Seven articles vaguely proposed that girls will not engage in risky sexual behaviours, but did not back-up these claims. The idea that girls will increase their risky sexual health behaviour after receiving the HPV vaccine was simply rejected and named experts were quoted in four of these articles.

Professor Henry Kitchener … dismissed protests that such a vaccine programme would encourage sexual promiscuity (Daily Mail 31/03/2006)

Parents' views

Twelve articles, all published since June 2006, considered parents' views about the effect of the HPV vaccine on girls' sexual behaviour. Two of these stories stated that parents 'in general' were concerned about adolescent sexual behaviours following vaccination.

The move will be controversial with some parents, who fear the jabs will encourage unprotected sex (The Observer, 24/12/2007)

However, most articles reported positive attitudes among parents (10/92). Most of these stories (8/10) provided evidence from specific studies conducted by Cancer Research UK (e.g. Marlow, 2007a) and researchers at the University of Manchester (e.g. Brabin et al., 2006) and gave numerical findings. These stories were often printed in broadsheet newspapers, and probably corresponded to press releases relating to the publication of the specific research findings.

In January this year, Cancer Research UK found that …only 12 per cent [of mothers] thought it might encourage promiscuous behaviour (The Daily Telegraph, 27/10/2007)

One news story described the opinions of individual mothers (Daily Mail 22/06/2007). Some of these mothers acknowledged the sexually transmitted nature of HPV, but stated that they did not believe that vaccination would result in risky sexual behaviour in their daughters. However, these women's views were countered by other aspects of the article which asserted that mothers *in general* were expressing "grave concerns" about the vaccine. Additionally, one mother was quoted as being "realistic" in believing that the vaccine will raise issues surrounding sex when her daughter is older.

DISCUSSION

As the HPV immunisation programme has been rolled-out across the UK, the media are likely to have played an important role in shaping public debate about the vaccine, in particular, whether or not they focused on the issue that the vaccine might have an adverse impact on adolescent sexual behaviour. In the present study UK national newspaper stories addressing this issue were examined and the types of views proposed were assessed, as well as the content of the arguments. As was hypothesised, media coverage of the vaccine grew substantially since the announcement of its development, and the issue of girls engaging in risky sexual behaviours following vaccination was a minor, but increasing theme over the five years studied.

The increasing media coverage of the HPV vaccine appears to be a feature of news reporting both in the UK and the USA (Kelly et al., 2009) reflecting the public's interest in this topic, but only a minority (42%) of articles identified by the original search in the present study considered the issue of girls engaging in risky sexual behaviours following vaccination and it was the predominant theme of only 14% of articles. However, the issue continued to be discussed over the search period and the presence of this constant discourse over many years is likely to have had an impact on readers (Menashe & Siegel, 1998). Other studies have also reported that such discussions are occurring in the media and to a similar extent. Descriptive studies of American news articles on the internet and American and Canadian newspaper articles have found discussions of concern about vaccination recipients increasingly engaging in risky sexual behaviour to occur in 20-38% of articles reviewed, but the specific details of these discussions were not reported (Abdelmutti &

Hoffman-Goetz, 2009; Calloway et al., 2006; Habel et al., 2009). Hilton, Hunt, Langan, Bedford and Petticrew (2010) after the present study was performed conducted an analysis of British newspaper articles that discussed the HPV vaccine between January 2005 and December 2008 (slightly extending the coverage of the search in the present study). Using similar methods to the ones described in the present study they identified 344 articles that mentioned the HPV vaccine. Their content analysis found 48% of articles made reference to the vaccine encouraging risky sexual behaviour suggesting that that the debate is continuing to be discussed, perhaps increasingly so. Wallace and Ache (2009) analysed evening news broadcasts about the vaccine on five American networks and reported that references to moral concerns were much more frequent (85% of broadcasts referred to moral or political issues), although the nature of these concerns were not detailed and a proportion of these will likely have not considered sexual behaviour at all.

Although in the present study the issue of risky sexual behaviour following HPV vaccination was increasingly discussed in news articles, it was usually covered briefly and where endorsed, this was often based on the opinions of unspecified opposition groups, religious groups and conservative family groups and this appears to mirror the findings of Hilton et al. (2010) and an unsystematic analysis of UK news articles (Quilliam, 2006). Articles that were predominantly negative in tone were published when the UK government announced that the HPV vaccine was to be introduced into the childhood immunisation programme and it was in these months that the percentage of articles mentioning risky sexual behaviour as a proportion of all articles discussing the vaccine was highest (80-100%). Similarly discussions of risky sexual behaviour and HPV vaccination in the American media reduced after the government recommended the vaccine for use (Habel et al., 2009). The number of articles that were predominantly positive in tone decreased over time, but this is likely to be due to the initial excitement surrounding the development of a cancer-preventing vaccine subsiding. It seems that most parents who read newspapers will at some point have been made aware of opposition towards vaccinating schoolgirls and to the idea that the HPV vaccine could encourage risky sexual behaviour, however in agreement with the null hypothesis most articles were neutral/balanced in tone.

Over a quarter of articles in the present study detailed a variety of counter-arguments suggesting why behaviour change is unlikely to occur, a small number of which were supported by named 'experts'. Many of these discussions were presented alongside arguments suggesting that behaviour change will occur. This was also the case in Hilton et al's (2010) analysis. This finding of neutrality of reporting is comparable to a recent analysis of YouTube coverage of the vaccine (Ache & Wallace, 2008) and another analysis of Canadian and American newspaper articles (Abdelmutti & Hoffman-Goetz, 2009). These studies as a whole suggest that as the HPV vaccine news story progresses articles appear to be becoming more likely to be neutral in tone, reflecting attempts to keep journalism balanced that have been reported in other media analysis (Hargreaves et al., 2003). Journalists use balanced reporting to present more entertaining stories and be fair to all sides, however, these practises have been considered inappropriate when reporting science as personal opinion is considered to be less valid than scientific findings (Offit, 2008). Offit argues that there is a difference between balance and perspective, and by presenting both arguments equally readers cannot gain true perspective on the issue. It is not the role of the media to educate the public about health interventions, nor to solely represent the position of public health officials (Habel et al., 2009). However, vaccination programme managers need to remain aware of how they can use the media to influence public opinion and be prepared to ensure that powerful anti-vaccination sentiments represented in the press are countered (Leask et al., 2009).

The qualitative differences between the arguments presented might influence the extent to which parents are influenced by them. Discussions in the articles that were more oppositional in tone often included emotional language, citing individuals from organisations who claim to be protecting the best interests of children, whereas supporting arguments were more rational and endorsed by science. Epstein (1991) suggests that emotional information is less effortful to process than rational information. The use of the differing emotional or rational discussions about the vaccine may influence how readers respond to the information they have received. If emotional information is easier to process and so more likely to be remembered it may be that the oppositional positions that used some emotion-based language will have been easier for parents to understand rather than 'rational' scientific arguments. It is also possible that parents who lack trust in the

government and science may be more inclined to agree with those who oppose the immunisation programme. Lack of trust in the government has been found to predict HPV vaccine acceptability (Marlow et al., 2007b) and has yet to fully recover from the MMR debacle. Trust in vaccination authorities comes in various guises: believing that authorities are withholding safety data, lack of confidence in the knowledge needed to justify not vaccinating a child or believing oneself to be a responsible parent for not implicitly trusting what authorities recommend. It may therefore be beneficial for communication interventions to use information about the HPV vaccine as a way of trying to build parents' trust in immunisation more generally. Parents need to be armed with communication tools to help them discuss the HPV vaccine and sex with their daughters to ensure that they understand that safe sexual behaviours are still necessary to prevent other STIs and pregnancy so that parents feel comfortable consenting to vaccination.

A small number of articles discussed parents' views about the vaccine and only a minority of these were negative and this was also the finding of Hilton et al. (2010). Articles that reported positive attitudes among parents referenced scientific studies, often citing statistics. These articles will have given their readers the opportunity to hear normative beliefs as they cited statistics about 'other parents'. Descriptive norms are associated with intention to perform health-related behaviours (Rivis & Sheeran, 2003) and intentions in turn relate to actual behaviour (Conner & Sparks, 2005). With this in mind, news stories that included statistics stating that most parents are not concerned about adolescent sexual behaviour following vaccination may have decreased the number of readers themselves worrying about this issue; consequently more parents may intend for their daughter to receive the vaccine. However, these stories were published infrequently and most appeared in broadsheet newspapers, whose readers are more likely to be from higher social classes than readers of tabloid or middle-market papers (Newspaper Marketing Agency, 2009) and their use of statistics may only have allowed their more numerate readers to fully comprehend them. Furthermore, although all types of newspapers referred to the issue of risky sexual behaviour following HPV vaccination it was not considered by all newspapers under review (some tabloid and middle market newspapers did not discuss the issue once). This descriptive finding is supported by the findings of Hilton et al. (2010) who also found tabloid newspapers to be less likely to mention the issue of risky sexual behaviour than

broadsheet newspapers, although middle-market papers were just as likely as broadsheet papers to address the issue. Thus individuals from lower social classes and possibly the less educated are less likely to have been exposed to these normative beliefs and knowledge inequalities between social classes may widen. Tichenor, Donohue and Olien (1970) call this the 'knowledge gap hypothesis' where the mass media offer more information to higher social classes leaving other groups less informed when arguably they have the most to gain from HPV vaccination (Quinn et al., 2001). Future research should examine parental reactions to media representations of the HPV vaccine and adolescent risky sexual behaviours to objectively elucidate how current portrayals affect parents with a special consideration to socio-economic inequalities.

As with all qualitative research the interpretation of the data in this present study is subjective. The analysis was not performed blind and pre-existing perceptions of the analyst about particular newspapers or opinions about the HPV vaccination may have affected the results. Qualitative methods cannot be validated or their reliability tested using quantitative techniques, instead qualitative warranting procedures must be employed to ensure that the interpretation of the data is appropriate. Although there is no definitive approach to validating qualitative methods (Smith, 2002) this study did use warranting techniques that have been identified by other researchers as being appropriate for this task. Triangulation is the process by which multiple approaches are taken to enhance the completeness of the analysis. This may be in the form of multiple researchers (investigator triangulation) or multiple methodologies (methodological triangulation; Tindall, 1998). Tindal (1998) recommends the use of multiple levels of triangulation to gain the most complete analysis of the data.

The present study used investigator triangulation by conducting analysis in close discussion with colleagues working in the field of HPV vaccination. Methodological triangulation was also achieved by the use of qualitative and descriptive quantitative methods and by bringing in findings from research that has used alternative methods. The transparency of framework analysis in charting the data and the examples given in the results section allowed others to examine the interpretation of the data and also afforded independent audit

in the manner recommended by Yin (1989). Contextual validity was assured in this discussion section as the findings of the present study were compared to other examinations of HPV in the media and similarities in the findings between studies assured the internal coherence of the present study (whether the interpretation made sense). The setting of the study was ecologically valid as the newspapers articles were available already in the public domain with no interference from the analyst. Finally the methods employed in this study were comparable to similar studies published after the present study was completed and similar findings tend to give support for the validity of the results in the present study. Hilton et al. (2010) made distinctions based on newspaper type and looked at the tone of included articles; Habel et al. (2009) and Abdelmutti et al. (2009) considered tone also. Many studies have used online databases to search for newspaper articles (Abdelmutti & Hoffman-Goetz, 2009; Anhang et al., 2004a; Calloway et al., 2006). Other warranting procedures could have been used such as member validation and reflexive analysis (Smith, 2002) in which the analysis is discussed or created in discussion with the individuals who provided the responses (the journalists). However, it was not feasible to involve the journalists in the analysis of the present study as they were never aware of their involvement. Furthermore the analysis was descriptive rather than interpretive so may not have benefited from such reflexive practices.

This study provided the first systematic analysis of media coverage of risky sexual behaviour and HPV vaccination in the UK, examining a large number of news stories over an extended period of time. The framework analysis was conducted rigorously and the newspaper search was thorough; the NexisUK database is as accurate as a hand search of papers (Wells et al., 2001). By excluding articles in local/regional publications and examining national newspapers only, it became possible to focus on the types of discussions that large sections of the public were exposed to, regardless of geographical location. To date only articles published in English language newspapers have been analysed so conclusions can only be drawn about the dominant Western media outlets.

Conclusions

The study highlighted that the argument that girls will engage in risky sexual behaviour following vaccination has been regularly, but briefly discussed in most of the papers. The articles covered both sides of the argument and allowed parents the opportunity to form opinions. Arguments against the view that HPV vaccination will result in girls engaging in risky sexual behaviour were more varied and better elaborated than those supporting the argument, but may have a less emotive appeal. Parents have been given the opportunity to hear about the experiences of others and this analysis indicated that most reports said that parents are not unduly concerned about adolescent risky sexual behaviour following vaccination. Nonetheless, the idea that girls will increase their risky sexual behaviour following vaccination was consistently proposed in the national press and had the potential to negatively affect parents' attitudes towards vaccination. Now that it is established what media messages parents are being exposed to regarding HPV vaccination and risky sexual behaviour, it is necessary to measure the beliefs that parents themselves have about the vaccine and this issue.

Chapter 5 - Mothers' beliefs about HPV vaccination and risky sexual behaviour

BACKGROUND[10]

The literature review in Chapter 2 revealed that some parents are rejecting HPV vaccination because of concerns about girls engaging in risky sexual behaviour following vaccination. An analysis of newspaper articles in Chapter 4 showed that parents may regularly be exposed to the argument that HPV vaccination will impact on adolescent sexual behaviour and these articles have the potential to affect personal concerns about the vaccine. The concerns expressed by parents fall into two groups: concern that girls will engage in more risky sexual behaviour and concern about implicitly encouraging sexual debut.

The first type of concern expressed by parents is apprehension that girls will engage in more risky sexual behaviour following HPV vaccination because they believe that they have a reduced risk of catching an STI, for example increasingly engaging in unprotected sex, having sex more often, at an earlier age and with a greater number of partners. A number of studies have reported that some parents do have these concerns and some have shown such concerns to be associated with intentions to allow a daughter to receive the HPV vaccine. Olshen, Woods, Austin, Luskin and Bauchner (2005) conducted a qualitative study with 25 American parents finding some to report concern that HPV vaccination might cause girls to adopt unsafe sexual practices. Marlow, Waller and Wardle (2007a), in a sample of 684 British mothers, found that those who believed that their daughter would be more likely to have unprotected sex after receiving the vaccine were less likely to intend to allow their daughter to have the HPV vaccine, but this result did not remain when other correlates of vaccination intention were adjusted for. In the same study, Marlow et al. also found mothers to be apprehensive about their daughters being more

[10] This study was completed in May 2008. Literature available at this time which contributed to the rationale for this study is presented in the introduction. Literature published after May 2008 is introduced in the discussion section. This study was published as part of a two-study paper in the Journal of Adolescent Health (Appendix 9).

likely to have sex following HPV vaccination and again this was associated with intentions to decline the vaccine, but not in multi-variable tests.

Constantine and Jerman (2007) reported that some American parents cited concern about girls being more likely to have sex after HPV vaccination as a reason for not intending to vaccinate a daughter before age 16 or not at all. Davis, Dickman, Ferris and Dias (2004) found parents who were opposed to HPV vaccination after reading information about HPV were more likely than those not opposed to vaccination to cite this as a concern about the vaccine. Woodhall, Verho, Huhtala and Hokkanen et al. (2007) found that when answering in the context of HPV vaccination, 42% of Finnish parents believed that an STI vaccine would lead to girls having sex earlier and this was associated with a lower intention to accept the HPV vaccine for a daughter in both univariate and multi-variable tests. Ogilvie, Remple, Fawziah, McNeil and Monika et al. (2007) reported that Canadian parents who believed that the HPV vaccine would have a negative influence on sexual behaviour were less likely to intend to vaccinate their daughter in both univariate and multi-variable tests. Finally concerns about increased sexual promiscuity have been reported, but only in one study and by one parent (Lenselink et al., 2008).

Some parents have also reported concern that HPV vaccination consent (implicitly) confers '*carte blanche*' consent for sexual activity in their daughters (Bair et al., 2008; Brabin et al., 2008; Constantine & Jerman, 2007; Toffolon-Weiss et al., 2008; Waller et al., 2006). One parent in a focus group study by Waller et al. (2006) explained this succinctly: *'some kids would go "excellent, that means I can sleep with whoever I like" you know and it's almost giving them carte blanche'*. This concern shall be explored in more detail in Chapter 6.

It has clearly been established that some parents hold these concerns about the HPV vaccine, but there have not been further investigations into their nature. Studies that have considered these concerns have explored them secondarily to acceptance of the vaccine, the prevalence of these concerns has not often been reported and the majority of existing studies have been conducted outside of the UK. It is likely that cultural issues specific to

attitudes towards sexual behaviour in the UK will impact on mothers' concerns and need to be considered. Such concern relates to the principles behind Risk Compensation theory (Adams, 1985; Adams, 1988; Wilde, 1982). Parents are worried that girls will perceive their risk of an STI to have lowered following vaccination and so be willing to engage in riskier sexual behaviour so that their optimal level of risk is restored.

This study investigated the first type of concern that mothers' have reported, concern that girls will engage in more risky sexual behaviour following HPV vaccination, focusing specifically on beliefs about sexual behaviour and was designed to achieve aim two of this thesis: to establish the degree of concern that parents feel about HPV vaccination and sexual behaviour. The analysis in this chapter was conducted on an existing dataset collected before I became involved in HPV research. This dataset came from a study in which mothers, recruited from across the UK, were asked to participate in a quantitative face-to-face structured interview conducted in their home. Mothers were asked specifically about their beliefs about sexual behaviour in girls following HPV vaccination and the nature of these beliefs was explored in analysis. The study was commissioned by GlaxoSmithKline (GSK) to validate an earlier internet-based international market research survey that GSK had designed and conducted in collaboration with the market research company TNS. Three chapter-specific research questions were posed:

1. Do mothers believe that risky sexual behaviour may increase following HPV vaccination?

2. Do beliefs about risky sexual behaviour predict mothers' willingness to consent to their daughters receiving the HPV vaccine?

3. What predicts whether mothers believe that risky sexual behaviour may increase following HPV vaccination?

Based on the findings of previous research it was hypothesised that a minority of mothers would believe that risky sexual behaviour may increase following vaccination and that these concerns would predict mothers' willingness to consent to their daughters receiving

the HPV vaccine. Previous research has not investigated the type of parent who is likely to hold views about increases in risky sexual behaviour following HPV vaccination so a hypothesis about this research question was not made.

METHODS[11]

Participants

Mothers with daughters under the age of 16 were recruited through an omnibus survey conducted in two waves by the National Centre for Social Research (NatCen). NatCen are an independent social research organisation who conducts large-scale research nationally. They conduct an omnibus survey six times a year and researchers can pay to have their questions included in the survey. This method of recruitment benefited from sampling participants from across Great Britain using stratified random probability sampling, stratifying by Government Office Region (GOR) and then by area-level National Statistics Socioeconomic Classification (NS-SEC, a measure of employment type). This method has previously been used for large surveys such as the Health Survey for England, commissioned by the Department of Health and the National Survey of Sexual Attitudes and Lifestyles funded jointly by the Wellcome Trust and Medical Research Council. The method allowed data to be collected quickly, using a professional and experienced organisation and sampled a large number of participants.

Participants were approached to take part after their address had been chosen from a postcode address file (PAF). Great Britain is divided into 10,631 postcode sectors, and 122 from mainland Great Britain were systematically selected with probability proportional to size. At each wave 25 addresses were randomly selected from each postcode sector (N=3050 at each wave), were approached and an individual residing in that address over

[11] This study was performed before I started my PhD and became involved in HPV vaccination research. The study was conceived, designed and implemented by Professor Wardle, Dr Waller and another colleague Dr Laura Marlow. The study was funded by GlaxoSmithKline. I performed the analysis on this existing dataset with advice from our statistician Mr David Boniface and from Professor Wardle and Dr Waller. Dr Marlow and I wrote the findings from this study and another study for a single publication with advice and input from Dr Waller and Professor Wardle. I discussed the study extensively with staff from NatCen who conducted the research to ensure that the methods described are accurate and detailed.

the age of 16 was asked to participate in a computer-assisted face-to-face interview conducted in the home by a trained researcher. Interviews could only be conducted with individuals living at the selected addresses. As shown in Table 5.1, 2981 individuals completed the interview, with data being available for 2971. Only women who identified themselves as having a daughter under the age of 16 were used in this analysis (n=341). Post-hoc power calculations showed that this sample size would have detected Pearson's effect sizes of >.16 with over 80% power. NatCen did not provide a response rate broken down by gender but a higher percentage of women than men completed the interview suggesting that the response rate for women would have been slightly higher than 53%. The research did not require formal ethical committee approval; however NatCen abides by the Social Research Association ethical guidelines.

Table 5.1 - Response rates and reasons for non-interview

	N	% of original addresses	% of eligible addresses	% of productive interviews
Issued addresses	6100	100		
Ineligible addresses	515	8.4		
Eligible addresses	5585	91.6	100	
Non-contacts	425		7.6	
Refusals	1839		32.9	
Other non-interview	248		4.4	
Unknown eligibility	92		1.6	
Productive interviews	2981 [a]		53.4	
Male respondent				46
Female respondent				54

[a] 10 cases were removed by NatCen from the dataset due to incorrect selection procedures having been applied.

Measures

Questions for the present study were imbedded within the larger omnibus survey; see Appendix 6 for the measures for the present study.

Beliefs about risky sexual behaviour following HPV vaccination

Beliefs about risky sexual behaviour following HPV vaccination were elicited using three statements: 'having the HPV vaccination might make girls more likely to have sex', 'girls who had the HPV vaccination would be more likely to have unprotected sex' and 'vaccinating young girls against HPV would encourage sexual promiscuity'. Women were asked to respond on a five-point scale to these statements indicating the strength of their agreement with them ('strongly disagree' to 'strongly agree'). The items were developed to encompass a number of parents' concerns about sexual behaviour following vaccination that have been expressed in previous studies (Constantine & Jerman, 2007; Lenselink et al., 2008) and two were used by Marlow et al. (2007a).

Willingness to consent to HPV vaccination

Willingness to provide consent to HPV vaccination for their daughter was assessed with one item adapted from Gibbons, Gerrard, Cleveland, Wills and Brody (2004) that asked mothers to respond on a 10-point scale to the following question: 'Please think about your daughter's current situation. How willing would you be to get her vaccinated with this vaccine for the prevention of infection with the HPV virus that causes cervical cancer?' (1=not at all willing to 10=extremely willing). Behavioural willingness was developed as an attempt to better predict behaviours that are unplanned, in place of behavioural intentions (Gibbons et al., 1998). It was designed to be used when measuring adolescents' willingness to adopt risky behaviours that they may not have encountered before or could not imagine having the opportunity to engage in, such as recreational drug use. At the time of the interviews the HPV vaccine was only recently developed and knowledge was established to be low (Klug et al., 2008); as a result it was anticipated that the respondents would not have previously planned whether they would accept HPV vaccination for their daughter and behavioural willingness was considered a suitable measure.

Perceived risk of cervical cancer

Perceived risk of cervical cancer was assessed using a single item adapted from Diefenbach, Weinstein and O'Reilly (1993). Women were asked to respond on a seven-point scale to the question 'what do you think your chances of getting cervical cancer in the future are?' (1=no chance to 7=certain to happen).

Perceived severity of cervical cancer

Perceived severity of cervical cancer was measured by asking women to indicate on a 10-point scale how serious they believed cervical cancer to be (1=not at all serious to 10=extremely serious, with an option for not being aware of the condition). This item was developed by GSK/TNS and was used to replicate the earlier GSK/TNS internet-based international market research survey.

Cervical cancer screening attendance

Women were asked to choose one of four possible statements that best described their previous cervical cancer screening attendance ('I regularly have cervical cancer screening/smear tests and do not need reminding' or 'I regularly have cervical cancer screening/smear tests but do need reminding' or 'I do not have regular cervical cancer screening/smear tests in spite of reminders to do so' or 'I have never had a cervical cancer screening/smear test'). Again this item had been developed by GSK/TNS and used to replicate their earlier survey.

Demographic questions

Demographic questions and responses came from a standard set used by NatCen. Using predefined categories the women were asked to select their age, ethnicity, highest educational qualification, their own and partners' income (both before and after any tax deductions) and employment type classified using NS-SEC 3 (National Office of Statistics, 2007). Respondents reported their previous awareness of HPV by responding to the question 'before this interview, were you aware of HPV?' (response: 'yes', 'no').

Procedure

Participants were approached in November 2006 and February 2007. Prior to a researcher approaching an address respondents were contacted by letter explaining that they had been selected to take part in research, detailing the nature of the research and reassuring confidentiality and anonymity. Included with this letter was a packet of first class stamps given as an incentive to take part. Interviewers attempted to make contact with an individual living at each address four times before an address was considered a 'non-contact' (including at least one day at the weekend, and one weekday evening).

The questions for the present study were only asked to women. The first questions for the present study that were included in the interview schedule asked participants about their awareness of HPV and perceived risk of cervical cancer. Following these questions, the women received brief information about HPV and the HPV vaccine (see Appendix 6). Information about HPV was provided to participants as at the time of interview the vaccine was only recently developed and knowledge of HPV reported prior to the development of the vaccine was low (Klug et al., 2008). All other questions were then completed using computer-assisted interviewing (CASI). The CASI programme routes the interviewer to each relevant question based on the respondent's previous answers, removing participant and interviewer burden in having to decipher which next question is appropriate to answer/ask. It also makes it harder for questions to be missed, reducing the amount of missing data. CASI also benefits the researcher as the data is immediately entered into an electronic database ready for analysis. As part of the omnibus survey other researchers independent to the HPV study included questions in the two waves of data collection. In both waves participants also responded to questions about health and work, and reform of incapacity benefit. In addition, in wave one questions about public transport, disability and public services, and active aging were included and in wave two questions were asked about child support and mental health.

Analysis

Data were analysed using SPSS 14 for Windows (SPSS Inc., 2005). Household income was calculated by summing the mean income ((income with deductions + income without

deductions)/2) for both the respondent and any partner. Too few participants identified themselves as belonging to some ethnic groups making group sizes too small for statistical comparisons to be made. These groups were grouped together and labeled as 'other'. The creation of an 'other ethnicity' group meant that inferences could not be made about that group specifically, only comparisons made with it. Too few participants had achieved certain educational qualifications so these groups were combined: postgraduate degree and first degree became 'degree or higher', higher education (below degree level) and A Level or equivalent became 'A Level or higher education below degree', O Level or equivalent and CSE or equivalent became 'GCSE or equivalent' and 'don't know', foreign qualifications and other qualifications were classified as 'missing'. Cervical screening attendance was dichotomised due to small original group sizes by combining those who responded 'I regularly have cervical cancer screening/smear tests and do not need reminding' and 'I regularly have cervical cancer screening/smear tests but do need reminding' and combining those who responded 'I do not have regular cervical cancer screening/smear tests in spite of reminders to do so' or 'I have never had a cervical cancer screening/smear test'.

The three risky sexual behaviour statements were highly correlated (Cronbach's α=.87) therefore a total risky sexual behaviour belief score was calculated by summing the respondents' scores on these three questions (maximum score of 15, higher scores indicating stronger agreement that sexual behaviour would change). There was no difference in the household income of participants of pensionable age ($\geq$ 60 years old) and those younger than 60, therefore age was not adjusted for in analysis using income (p=.98, Appendix 7). Five women over the age of 65 identified themselves as being mothers of daughters under the age of 16. It was assumed that these women were the primary guardians of girls under the age of 16 and their data were included in analysis. These women did not differ from the rest of the sample for any of the dependent variables (data not shown). For the cervical screening analysis only women who were below the screening age were included (younger than 65). In the UK women aged 65 and older who have received three consecutive negative cervical screening results are no longer included in the call and recall system. In the present study a number of women who were still eligible for screening may have been excluded inappropriately however previous cervical screening

results were not recorded and the sample was not reduced considerably by excluding women aged 65 and older.

On the whole the percentage of missing data from the original dataset was low (Table 5.2). The item 'perceived severity of cervical cancer' had a high percentage of missing responses which may have been due to unawareness of the condition resulting in a large number of participants using the response option 'I have never heard of this condition'. Household income also had a high percentage of missing responses which may be explained by participants preferring to keep such personal information private. Missing data were dealt with using the expectation-maximisation (EM) algorithm of missing values analysis (MVA) on continuous variables. EM is an iterative procedure that uses the known parameters in the data to estimate the unknown parameters. These filled in data are then used to inform other missing parameters. The algorithm adds some error to the parameters it is estimating until the solution becomes stable. MVA computed two negative numbers for household income and these two cases were recoded as 'missing' from household income analysis.

Preliminary analysis demonstrated that the data were not normally distributed; minor skewness and kurtosis for the main variables was apparent although the data looked normally distributed graphically (data not shown). Skewness and kurtosis could not be resolved by transforming the data. However as the data looked normally distributed when presented graphically and the sample size was large it was decided that parametric statistics were robust enough to deal with minor distribution problems in the dataset. In cases where Levene's tests showed the variance in the data to be heterogeneous non-parametric tests were run in addition to parametric tests. The results of the parametric tests only were reported unless the two types of test differed in their findings.

To test whether relationships existed between the independent variables Fisher's chi-square statistic was used for analysis of two categorical variables and independent t-tests or ANOVAs to establish differences between categorical and continuous variables. Cramer's V was used as an effect size for chi-square analysis. Associations between two continuous

variables were assessed using correlations. Significant differences between these variables were adjusted for in subsequent analysis. To test whether beliefs about risky sexual behaviour following HPV vaccination affected the mothers' willingness to consent to HPV vaccination ANCOVAs, and two-tailed Pearson's and partial correlations were used. Post-hoc comparisons were made using Bonferroni tests and H^2 for ANCOVAs were converted into Pearson's r to determine the size of any effect. Variables that had a p of <.05 were entered into a multiple linear regression to establish predictors of willingness to have a daughter vaccinated against HPV. To test whether variables were associated with the mother's beliefs about risky sexual behaviour following vaccination or whether groups differed in their strength of belief, ANCOVAs and Pearson's and partial correlations were used. Post-hoc comparisons were made using Bonferroni tests. Variables with a p value <.05 were entered into a multiple linear regression to establish predictors of beliefs about risky sexual behaviour.

Table 5.2 - Percentage of missing responses from original dataset

	Percentage of cases missing
Willing to have daughter vaccinated against HPV	1.49
Having the HPV vaccination might make girls more likely to have sex	1.79
Girls who had the HPV vaccination would be more likely to have unprotected sex	1.49
Vaccinating young girls against HPV would encourage sexual promiscuity	1.19
Perceived severity of cervical cancer	29.41
Perceived risk of getting cervical cancer	5.25
Household income	18.40
Age	0.00
NSSEC3	0.00
Education	0.00
Aware of HPV	0.30
Cervical screening attendance	0.91
Ethnicity	0.00

RESULTS

Characteristics of the sample

Mothers in this sample had an average age of 38 and 90% were White (Table 5.3). The average household income was £27,446, the majority of respondents were in routine or manual professions (42%) and 41% had GCSE qualifications or equivalent. Most regularly attended cervical cancer screening (88%). The majority of respondents believed that cervical cancer was serious (mean=9.4 out of 10; Table 5.4) and most were not previously aware of HPV (77%). Most mothers believed their perceived risk of getting cervical cancer to be moderate (mean=3.6 out of 7; Table 5.4).

Table 5.3 – Demographic characteristics

	n (%)/mean (sd)
Ethnicity (n=341)	
White	306 (89.7)
Other	35 (10.3)
NS-SEC 3 (n=341)	
Managerial and professional occupations	94 (27.6)
Intermediate occupations	83 (24.3)
Routine and manual occupations	143 (41.9)
Not classifiable	21 (6.2)
Cervical screening attendance (n=335)	
Regular cervical screening	293 (87.5)
Irregular cervical screening or non-attendees	40 (11.9)
Education (n=339)	
None	62 (18.2)
GCSE or equivalent	139 (40.8)
A Level or higher education (below degree)	94 (27.6)
Degree or higher	44 (12.9)
Age (n=341)	38.17 (9.23)
Household income (n=341)	£27,446 (30,187)

Note: Columns not equaling total are due to missing data

Table 5.4 – Psychological variables (n=341)

	n (%)/mean (sd)
Having the HPV vaccination might make girls more likely to have sex	
Disagree strongly	46 (13.5)
Disagree	147 (43.1)
Neither agree nor disagree	90 (26.4)
Agree	53 (15.5)
Agree strongly	5 (1.5)
Girls who had the HPV vaccination would be more likely to have unprotected sex	
Disagree strongly	36 (10.6)
Disagree	144 (42.2)
Neither agree nor disagree	82 (24.0)
Agree	64 (18.8)
Agree strongly	15 (4.4)
Vaccinating young girls against HPV would encourage sexual promiscuity	
Disagree strongly	42 (12.3)
Disagree	143 (41.9)
Neither agree nor disagree	94 (27.6)
Agree	53 (15.5)
Agree strongly	9 (2.6)
Perceived severity of cervical cancer (range 1-10)	9.40 (1.23)
Perceived risk of getting cervical cancer (range 1-7)	3.59 (1.05)
Total risky sexual behaviour belief (range 0-15)	7.67 (2.67)
Willing to have daughter vaccinated against HPV (range 1-10)	7.86 (3.06)
Aware of HPV (n=340)	
Yes	80 (23.5)
No	260 (76.5)

Note: Columns not equaling total are due to missing data

Do mothers believe that risky sexual behaviour may increase following HPV vaccination?

Willingness to vaccinate a daughter was high (mean=7.9 out of 10, Table 5.4). Most 'disagreed' or 'disagreed strongly' that the HPV vaccine may cause girls to have more sex (57%; Table 5.4), unprotected sex (52%) or cause sexual promiscuity (54%). However, 17% 'agreed' or 'agreed strongly' that the HPV vaccine may cause girls to have more sex, 23% 'agreed' or 'agreed strongly' that girls would have more unprotected sex and 18% 'agreed' or 'agreed strongly' that the vaccine may cause sexual promiscuity. Overall, most appeared neither to agree nor disagree that girls would engage in risky sexual behaviour following vaccination (total risky sexual behaviour belief mean score=7.7 out of 15; Table 5.4).

Associations between independent variables

Some of the independent variables to be used in the analysis were associated with each other; these relationships were controlled for in the main analysis. NS-SEC3 differed by ethnicity ($\chi^2(3)=11.21$, $p<.01$, $V=.21$; see Appendix 7 for analysis tables and Appendix 8 for graphs of all significant effects). Graphically it appeared that White respondents were more likely to be in managerial/professional occupations, intermediate occupations or routine/manual occupations than respondents grouped as 'Other'. White respondents were more likely to be in managerial/professional occupations than in non-classifiable occupations. NS-SEC3 also differed by HPV awareness ($\chi^2(3)=15.99$, $p<.01$, $V=.22$) with those in managerial/professional occupations appearing graphically to be more likely to be aware of HPV than those in routine/manual occupations and also less likely to be not aware of HPV than those in routine/manual occupations. Education was associated with cervical screening attendance ($\chi^2(3)=14.09$, $p<.01$, $V=.21$), NS-SEC3 ($\chi^2(9)=121.3$, $p<.01$, $V=.3$), previous awareness of HPV ($\chi^2(3)=30.9$, $p<.01$, $V=.3$), education ($\chi^2(9)=121.3$, $p<.01$, $V=.3$) and age ($F(3,335)=6.04$, $p<.01$). Graphically it appeared that mothers with no formal qualifications were older than those with GCSEs or equivalent and those with A Levels or equivalent or further educational qualifications (below degree level). Finally, cervical screening attendance was also related to being aware of HPV ($\chi^2(1)=6.85$, $p<.01$, $V=.14$). Graphically it appeared that regular screening attendees were more likely to be aware of HPV than irregular/non-attendees and also less likely to be not aware of HPV than non-attendees. See Appendix 7 for the tables reporting these findings.

Predictors of willingness to have daughter vaccinated

Possible psychological and demographic predictors of mothers' willingness to vaccinate their daughters against HPV were explored independently and then in multiple variable analysis. Mothers who disagreed that girls would engage in more risky sexual behaviour were more willing to have their daughter vaccinated against HPV (girls more likely to have sex $r=-.14$, $p=.01$; more likely to have unprotected sex $r=-.13$, $p=.02$; would encourage sexual promiscuity $r=-.11$, $p=.04$; total risky sexual behaviour $r=-.14$, $p=.01$; see Table 5.5) as were mothers who had a higher perceived risk of cervical cancer ($r=.22$, $p<.01$). See Table 5.5 and Table 5.6 for all other non-significant effects.

All dependent variables with a significance value of ≤.05 were entered into a multiple linear regression to establish predictors of willingness to vaccinate. Total risky sexual behaviour was used to represent all of the risky sexual behaviour variables to avoid co-linearity. The only variable that remained significant in the model was perceived risk of cervical cancer ($p<.01$; Table 5.7). Around 5% of the variance in willingness to vaccinate could be predicted by this model and for every 1 unit change in perceived risk of cervical cancer, willingness to vaccinate a daughter against HPV increased by .2 units.

Table 5.5 – Associations with willingness to have daughter vaccinated against HPV

N=341	Pearson/Partial Correlation	p
Age (adjusted for education)	-.05	.41
Household income	-.06	.27
Perceived risk of cervical cancer	.22	<.01
Having the HPV vaccination might make girls more likely to have sex	-.14	.01
Girls who had the HPV vaccination would be more likely to have unprotected sex	-.13	.02
Vaccinating young girls against HPV would encourage sexual promiscuity	-.11	.04
Total risky sexual behaviour belief	-.14	.01
Perceived severity of cervical cancer	.03	.64

Table 5.6 – Group differences for willingness to have daughter vaccinated against HPV

	n	Adjusted Mean	SE	P
Whether respondent attends cervical screening				.85
Regular cervical screening	290	7.79	0.18	
Irregular cervical screening or non-attendees	40	7.90	0.50	
Ethnicity				.77
White	306	7.86	0.18	
Other	35	7.83	0.52	
Aware of HPV			.	.93
Yes	80	7.80	0.35	
No	257	7.85	0.19	
NS-SEC3				.94
Managerial and professional occupations	94	7.60	0.33	
Intermediate occupations	82	7.75	0.35	
Routine and manual occupations	143	8.05	0.27	
Not classifiable	19	7.80	0.76	
Education				.73
None	56	7.48	0.50	
GCSE or equivalent	136	8.07	0.34	
A Level or higher education (below degree)	94	7.89	0.27	
Degree or higher	44	7.43	0.46	

Table 5.7 – Multiple regression examining predictors of willingness to vaccinate

	B	SE B	β	p[a]
Constant	6.56	.86		<.01
Perceived risk of getting cervical cancer	0.58	0.16	.20	<.01
Total risky sexual behaviour belief score	-0.10	0.06	-.09	.11

[a] Adjusted R^2=.05 (p<.01), N=341

Predictors of risky sexual behaviour beliefs

Potential psychological and demographic predictors of each risky sexual behaviour belief were considered independently. Each risky sexual behaviour statement was first considered on its own to establish the predictors of the specific concern and they were then explored as a measure of general concern about this issue (summed total of the three statements). Predictors with a p value <.05 for any of the first analyses and for any of the three belief statements and the summed total risky sexual behaviour belief score were then considered

in a multi-variable test to establish predictors of beliefs about risky sexual behaviour using the summed score.

Having the HPV vaccination might make girls more likely to have sex

Respondents who perceived themselves to be at higher risk of cervical cancer were less likely to believe that having the HPV vaccination might make girls more likely to have sex (r=-.22, p<.01; Table 5.8). Mothers who were previously aware of HPV were less likely to agree with this statement (F=17.94, p<.01, r=.22; Table 5.9). Mothers who attended regularly for cervical screening were less likely to agree that girls might have more sex (F=9.21, p<.01, r=.52). Finally, white mothers were more likely to believe that the HPV vaccination might make girls more likely to have sex (F=3.98, p=.05, r=.35; Table 5.9). See Table 5.8 and Table 5.9, which also includes non-significant effects.

Table 5.8 – Associations with the belief that 'having the HPV vaccination might make girls more likely to have sex'

N=341	Pearson/Partial Correlation	p
Age (adjusted for education)	-.03	.57
Perceived risk of cervical cancer	-.22	<.01
Household income	-.09	.11
Perceived severity of cervical cancer	.04	.47

Table 5.9 – Group differences for 'having the HPV vaccination might make girls more likely to have sex' controlling for independent variable associations

	n	Adjusted Mean	SE	p
Whether respondent attends cervical screening				<.01
Regular cervical screening	290	2.42	0.05	
Irregular cervical screening or non-attendees	40	2.89	0.15	
Ethnicity				.05
White	306	2.52	0.55	
Other	35	2.18	0.16	
Aware of HPV				<.01
Yes	79	2.08	0.16	
No	251	2.60	0.06	
NS-SEC3				.20
Managerial and professional occupations	93	2.66	0.11	
Intermediate occupations	82	2.51	0.10	
Routine and manual occupations	141	2.37	0.08	
Not classifiable	16	2.24	0.24	
Education				.22
None	56	2.47	0.13	
GCSE or equivalent	136	2.61	0.08	
A Level or higher education (below degree)	94	2.36	0.10	
Degree or higher	44	2.35	0.15	

Girls who had the HPV vaccination would be more likely to have unprotected sex

The independent tests showed that women who perceived themselves to be more at risk of cervical cancer were less likely to agree with the statement (r=-.25, p<.01; Table 5.10). Women who regularly attended for cervical screening were less likely to believe that the HPV vaccine might cause girls to have unprotected sex (F=4.13, p=.04, r=.11; Table 5.11). Finally, mothers who were aware of HPV were less likely to agree with the statement (F=10.47, p<.01, r=.17; Table 5.11). See Table 5.10 and Table 5.11.

Table 5.10 – Associations with the belief that 'girls who had the HPV vaccine would be more likely to have unprotected sex'

N=341	Pearson/Partial Correlation	p
Age (adjusted for education)	-.07	.19
Perceived risk of cervical cancer	-.25	<.01
Household income	-.10	.08
Perceived severity of cervical cancer	.02	.66

Table 5.11 - Group differences for 'girls who had the HPV vaccine would be more likely to have unprotected sex' controlling for independent variable associations

	n	Adjusted Mean	SE	p
Whether respondent attends cervical screening				.04
Regular cervical screening	290	2.61	0.06	
Irregular cervical screening or non-attendees	40	2.95	0.16	
Ethnicity				.94
White	306	264	0.06	
Other	35	2.65	0.18	
Aware of HPV				<.01
Yes	79	2.31	0.12	
No	251	2.76	0.07	
NS-SEC3				.93
Managerial and professional occupations	94	2.70	0.11	
Intermediate occupations	82	2.63	0.11	
Routine and manual occupations	143	2.64	0.09	
Not classifiable	21	2.55	0.23	
Education				.41
None	56	2.52	0.15	
GCSE or equivalent	136	2.79	0.13	
A Level or higher education (below degree)	94	2.65	0.13	
Degree or higher	44	2.70	0.17	

Vaccinating young girls against HPV would encourage sexual promiscuity

Mothers who perceived themselves to be less at risk of cervical cancer were more likely to agree that vaccinating young girls against HPV would encourage sexual promiscuity (r=-.26, p<.01; Table 5.12), as were women with a lower household income (r=-.2, p<.01;

Table 5.16). Mothers who were aware of HPV were less likely to believe that vaccinating young girls against HPV would encourage sexual promiscuity (F=12.36, p<.01, r=.20; Table 5.13). See Table 5.12 and Table 5.13.

Table 5.12 – Associations with the belief that 'vaccinating young girls against HPV would encourage sexual promiscuity'

N=341	Pearson/Partial Correlation	p
Age (adjusted for education)	-.07	.19
Perceived risk of cervical cancer	-.26	<.01
Household income	-.20	<.01
Perceived severity of cervical cancer	<.01	.97

Table 5.13 - Group differences for 'vaccinating young girls against HPV would encourage sexual promiscuity' controlling for independent variable associations

	n	Adjusted Mean	SE	p
Whether respondent attends cervical screening				.19
Regular cervical screening	290	2.52	0.06	
Irregular cervical screening or non-attendees	40	2.73	0.15	
Ethnicity				.27
White	306	2.56	0.06	
Other	35	2.37	0.17	
Aware of HPV				<.01
Yes	79	2.19	0.11	
No	251	2.65	0.06	
NS-SEC3				.75
Managerial and professional occupations	94	2.57	0.10	
Intermediate occupations	82	2.61	0.11	
Routine and manual occupations	143	2.48	0.08	
Not classifiable	21	2.66	0.22	
Education				.31
None	56	2.48	0.20	
GCSE or equivalent	136	2.84	0.15	
A Level or higher education (below degree)	94	2.57	0.18	
Degree or higher	44	2.54	0.22	

Total risky sexual behaviour belief score

When the three belief statements were summed into a total score, women with a higher household income were overall less likely to agree that sexual behaviour following HPV vaccination would change (r=-.14, p=.01; Table 5.14) as were women who perceived themselves to more be at risk of cervical cancer (r=-.27, p<.01; Table 5.14). Mothers who regularly attended for cervical screening were less likely to agree that behaviour would change (F=5.67, p=.02, r=.11; Table 5.15) as were women who were aware of HPV (F=16.82, p<.01, r=.22; Table 5.15). See Table 5.14 and Table 5.15.

All independent variables with a significance value of ≤.05 for any of the three statements or the summed total risky sexual behaviour belief score were entered into a multiple regression to establish predictors of total risky sexual behaviour belief score. The only variables that remained significant in the model were perceived risk of cervical cancer (p<.01), awareness of HPV (p<.01) and cervical screening attendance (p=.02; Table 5.16). Around 13% of the variance in risky sexual behaviour belief score could be predicted by this model. The largest proportion of variance in total risky sexual behaviour belief was explained by perceived risk of cervical cancer; as perceived risk of cervical cancer increased, total risky sexual behaviour belief decreased.

Table 5.14 – Associations with total risky sexual behaviour belief score

N=341	Pearson/Partial Correlation	p
Age (adjusted for education)	-.07	.23
Perceived risk of cervical cancer	-.27	<.01
Household income	-.14	.01
Perceived severity of cervical cancer	.02	.66

Table 5.15 – Group differences for total risky sexual behaviour belief score controlling for independent variable associations

	n	Adjusted Mean	SE	p
Whether respondent attends cervical screening				.02
Regular cervical screening	290	7.54	0.15	
Irregular cervical screening or non-attendees	40	8.59	0.41	
Ethnicity				.27
White	306	7.72	0.15	
Other	35	7.20	0.45	
Aware of HPV				.01
Yes	79	6.59	0.30	
No	251	8.01	0.16	
NS-SEC3				.80
Managerial and professional occupations	94	7.88	0.27	
Intermediate occupations	82	7.74	0.29	
Routine and manual occupations	143	7.54	0.22	
Not classifiable	21	7.54	0.58	
Education				.28
None	56	7.39	0.54	
GCSE or equivalent	136	8.47	0.40	
A Level or higher education (below degree)	94	7.86	0.47	
Degree or higher	44	7.55	0.58	

Table 5.16 – Multiple regression examining the predictors of total risky sexual behaviour score

	B	SE B	β	p [a]
Constant	7.80	0.77		<.01
Ethnicity	-0.45	0.45	-.05	.32
Screening attendance	1.27	0.42	.12	.02
Aware of HPV	1.30	0.32	.21	<.01
Perceived risk of getting cervical cancer	-0.61	0.13	-.24	<.01
Household income	<0.00	<0.00	-.10	.07

[a] Adjusted R^2=.13 (p<.01), N=332

DISCUSSION

This study aimed to examine mothers' HPV vaccination intentions, beliefs about girls engaging in risky sexual behaviour following vaccination, whether willingness to receive the vaccine would be affected by holding such beliefs and predictors of these beliefs. This was achieved in a study that used face-to-face structured interview methods to examine the beliefs of mothers of daughters under the age of 16.

Despite low levels of awareness of HPV, mothers appeared extremely willing for their daughters to receive the HPV vaccine. It is likely that awareness in mothers has increased substantially since this study was conducted given that the immunisation programme is now underway. Encouragingly, most mothers did not believe that HPV vaccination might cause girls to have more sex, unprotected sex or encourage sexual promiscuity.

However, a significant minority of mothers agreed that sexual behaviour may change following HPV vaccination and these beliefs on their own related to willingness to consent to their daughter receiving the HPV vaccine. This finding accords with previous studies of mothers that found some concern about the effect that HPV vaccination may have on their daughters' sexual behaviour because of a perceived reduction in susceptibility to STIs (Constantine & Jerman, 2007; Davis et al., 2004; Lenselink et al., 2008; Marlow et al., 2007a; Ogilvie et al., 2007; Olshen et al., 2005; Woodhall et al., 2007).

Since this study was conducted additional large studies have supported these findings. For example, Bernat et al. (2009) found 13% of parents believed that the HPV vaccine would encourage more sexual activity in their daughters and in Wu, Porch, McWeeney, Ohman-Strickland, and Levine's (2010) study 56% of Hispanic mothers/vaccine-eligible women held this belief when asked directly. Dahlstron et al. (2010) found 12% of Swedish parents to believe that the vaccine would encourage their daughters to have unprotected sex or more sexual partners and Stretch et al. (2008) reported that 4% of parents were 'quite' or 'very' concerned that the vaccine might encourage their child to be more sexually active. Perkins, Pierre-Joseph, Marquez, Iloka and Clark et al. (2010), in study of low-income

minority women, found some mothers to believe that girls will start having sex earlier and will be less cautious in their sexual behaviour because they will perceive themselves as 'invincible' after receiving the HPV vaccine. Finally, Ferris, Cromwell, Waller and Horn (2010) found 6.4% of American parents of 9-17 year olds to believe that the HPV vaccine would encourage their child to have sex. In accordance with the present study, Ferris et al.'s study did not report that there was an association between beliefs about risky sexual behaviour and mother's age, income or education. The authors did report that mothers were more likely to believe that vaccination would encourage girls to have sex if they had a higher number of daughters, if they had children aged 15-17 years, if they did not believe that vaccines are important, held moral or religious objections to vaccines generally and the HPV vaccine specifically, if they were concerned about the adverse effects of HPV vaccination and if they did not believe the HPV vaccine to be effective at preventing cervical cancer. Other studies have reported that such concerns are held although their prevalence was found to be much lower (Morison et al., 2010; Reiter et al., 2010; Sanderson et al., 2009; Tozzi et al., 2009).

The findings from the present study that these beliefs were associated with acceptance of the vaccine are further confirmed by Stretch et al. (2008), Marlow et al. (2007a), Ferris et al. (2010) and Bernat, Harpin, Eisenberg, Bearinger and Resnick (2009) who all found that these beliefs related to willingness to vaccinate a daughter against HPV in univariate analysis, although one small American study did not support these findings (Gerend et al., 2009).

In the present study the extent that mothers agreed that girls will engage in risky sexual behaviour following HPV vaccination could to some extent be explained by their demographic characteristics (household income and ethnicity) but also their previous awareness of HPV, previous attendance at cervical screening and risk perceptions. Mothers with a higher perceived risk of cervical cancer were less likely to agree that sexual behaviour would change and such risk perceptions were the most important contributor to such beliefs. It may be that mothers who have a high perceived risk of cervical cancer had a greater understanding of the reasoning behind the vaccine being administered prior to

sexual activity, although general awareness was not associated with perceived risk. Alternatively it may have been a result of cognitive dissonance, the psychological tension an individual experiences when they hold two conflicting cognitions (Festinger, 1957). In the present study mothers with a high perceived risk of cervical cancer were more willing to vaccinate their daughter and so may have been less likely to agree with the statements to avoid such psychological tension or it may have been that mothers who were unwilling to vaccinate their daughters used concern about sexual behaviour as evidence to support their decision not to vaccinate (bolstering cognitions). The implication of this interpretation is that addressing beliefs about risky sexual behaviour may not be the most effective way to increase vaccination uptake. This interpretation is likely to only be true for mothers who were previously aware of HPV as perceived risk of cervical cancer was assessed before information about the vaccine was introduced to the respondents.

Other factors that were related to mothers' beliefs about adolescent sexual behaviour following vaccination included previous awareness of HPV, previous cervical screening attendance, household income and ethnicity. The importance of HPV awareness suggests that agreement that risky sexual behaviour will increase following vaccination may have stemmed from a lack of understanding about HPV, and therefore by raising awareness of HPV vaccination, these issues might be less important for mothers. The introduction of HPV into the childhood immunisation schedule since this study was conducted is likely to already have contributed to this. The finding that mothers who did not attend for cervical screening were more likely to agree with the statements is probably related to awareness of HPV as those who engage with cervical cancer prevention services are likely to have been more knowledgeable than infrequent attendees. The role of household income in influencing these beliefs was unlikely to have been related to the type of job the mother had (NS-SEC3) or her education, as relationships did not exist between these independent variables suggesting that most of the women's income came from a partner. Further examinations of how household income impacts on beliefs about the HPV vaccine should be conducted; for example it may have been that daily activities and social engagement related to household income impacted on beliefs about sexual behaviour following HPV vaccination (such as engaging with friends who live in the same area as them) or that the women were influenced by the beliefs of their partner that were reflective of their partners'

income. Finally, ethnicity was associated with beliefs about girls' sexual behaviour. White mothers were more likely to agree that the vaccine might cause girls to have more sex; these results cannot be expanded upon as the comparison group was not large enough to be sufficiently powered and combined all other ethnic groups. These preliminary findings need to be replicated although their importance in explaining beliefs about risky sexual behaviour was minor as ethnicity did not remain significant in multiple regression analysis. Other research has not found a relationship between beliefs about risky sexual behaviour and mother's ethnicity (Ferris et al., 2010).

In multiple regression, beliefs about girls' sexual behaviour following HPV vaccination no longer predicted willingness to vaccinate, and perceived risk of cervical cancer was more important. This result replicated the finding of Marlow et al. (2007a) who reported that beliefs about girls being more likely to have sex generally and unprotected sex related to willingness to vaccinate a daughter in univariate but not multi-variable analysis (adjusted for religion, experience of cancer in the family, severity, susceptibility, social norms, normative beliefs, positive beliefs about HPV and general vaccination concerns). This is in contrast to the findings of Bernat et al. (2009) in the USA who reported that mothers of 5-18 year old daughters who believed that the vaccination would encourage girls to have more sex were less likely to have allowed their daughter to have the HPV vaccine in multi-variable analysis; Dahlstrom et al. (2010) who reported similar findings for beliefs about unprotected sex and number of sexual partners in Swedish parents and Canadian parents who were more likely to believe that the vaccine would have some effect on sexual practices (Ogilvie et al., 2010). These three studies had much larger sample sizes than the present study and Marlow et al.'s study so non-significant findings may have been due to lack of power or may have been due to cultural differences between the studies.

If the findings of the present study are correct they are reassuring as although mothers may believe that girls will engage in more risky sexual behaviour after vaccination, other factors are more strongly associated with their decision to consent to vaccination for a daughter. The effect of perceived risk appears to be so strong that it overrides other factors that may have been associated with vaccination decisions. As was detailed in Chapter 2, perceived

risk of cervical cancer has consistently been shown to be associated with HPV vaccination intentions (Marlow et al., 2007a; Natan et al., 2010; Ogilvie et al., 2007; Woodhall et al., 2007) and actual refusal of the HPV vaccine (Gerend et al., 2009; Reiter et al., 2009).

Qualitative investigations of vaccination-resistant groups have found risk to be an important rhetoric in their position against vaccination (Hobson-West, 2007). Such groups claim that governments are not objective and use risk information to promote vaccination. The groups suggest that vaccination causes new health risks and these risks are largely unknown (scientific trials are inadequate and are too short in duration). Further concern relates to their belief that vaccination risk is non-random and that certain individuals are more immunologically vulnerable than others (some reformist groups advocate testing all children's immunity prior to vaccination receipt). These groups do not claim that refusing vaccinations is the right answer and do not purport to fully understand the risks of non-vaccination but in the same vein they believe that vaccination authorities do not know all the answers either.

Perceived risk is also considered to be associated with behaviour in many social cognition models such as the Health Belief Model (Becker et al., 1977; Rosenstock, 1966), Protection Motivation Theory (Rogers, 1975; Rogers, 1983), Health Action Process Approach (Schwarzer, 1992; Schwarzer, 2001), all of which posit that perceived vulnerability or susceptibility to an illness relates to behavioural intentions. It is also highlighted as important in general models of vaccination decision making in parents such as the parental immunisation decision making model proposed by Sturm, Mays and Zimet (2005). This present study suggested that one's own perceived risk can inform proxy decision making or alternatively it may have been that self-perceptions of risk informed assessments of others' risk and it was this that influenced the mothers' willingness to agree to vaccination.

It makes theoretical sense that vaccination uptake could be maximized if mothers' perceptions of risk were targeted. For example, information materials could be tailored to focus on perceived risk, although it must first be determined whether it was the mothers' own perceived risk of cervical cancer or their perceived risk for their daughter that was

related to their vaccination intentions, to ensure that the correct cognitions are targeted. Simply providing mothers with information about the prevalence of HPV and the chance of contracting the virus or cervical cancer may increase risk perceptions. Additionally, framing information in specific ways has been found to increase risk perceptions, although this has been put to limited use in HPV vaccination to date.

Framing originates from Prospect theory (Kahneman & Tversky, 1979) which proposed that individuals risk-seek when a message is framed as a loss, but are risk averse when messages are gain-framed. Research has suggested that responses to such messages are dependent on the nature of the behaviour and that with low-frequency health-protective behaviours, such as one-off vaccination, the opposite is the case; individuals risk-seek when the behaviour is framed as a gain, but are risk-averse when the behaviour is loss-framed, due to the role of uncertainty (Rothman & Salovey, 1997). Thus it may be efficacious to provide mothers with loss-framed risk perceptions messages.

Gerend, Shepherd and Money (2008) provided support for this proposal finding that those with a low perceived risk of HPV were more likely to intend to receive the HPV vaccine if the HPV information they received was loss-framed and the vaccine was described as requiring only one dose. Similarly, Gerend and Shepherd (2007) found that vaccination intentions were greater for individuals who received loss-framed HPV information (as opposed to gain-framed) in participants who were likely to find the vaccine personally relevant (those who performed more risky sexual behaviours) and those who were avoidance-motivated. Additionally, decision aids have been used to facilitate medical decision making (O'Connor et al., 1999) and could be designed with a specific focus on perceived risk. Decision aids are tools developed to help patients in their healthcare choices by providing information on options and possible outcomes (O'Connor et al., 1999) and can appear in various formats, such as videos or counselling sessions with healthcare professionals. Although there are no established decisions aids for HPV vaccination (Sheinfeld-Gorin et al., 2006), they have been found to increase hepatitis B vaccination/screening uptake in physicians who originally intended use these services (Clancy et al., 1988) and poliovirus vaccine knowledge in parents of 2-3 month old infants

(Dunn et al., 1998). However, they have had a variable effect in improving HPV knowledge generally (Sheinfeld-Gorin et al., 2006). Such devices and techniques may be beneficial in helping to increase vaccination uptake if they incorporate the theoretical concepts that research, such as the present study, identify as contributing to vaccination intentions. One must consider the morality of increasing mothers' risk perceptions of cervical cancer given that it is a rare disease and may result in undue anxiety among the 'worried well'. Such psychological tools should only be used when they are justified and it could be considered that using them to increasing uptake of a vaccine that prevents a rare disease is not appropriate.

In contrast to the assertions of social cognition models such as the Health Belief Model (Becker et al., 1977; Rosenstock, 1966), perceived severity of cervical cancer was not associated with HPV vaccination decisions. Perceived severity of HPV and HPV-related disease has been found to be an important predictor of HPV vaccination intentions in some previous studies (de Visser & McDonnell, 2008; Kahn et al., 2008; Marlow et al., 2007a) but one earlier study has questioned its importance (Marlow et al., 2009) and of the three studies examining perceived severity and actual vaccination receipt detailed in Chapter 2, only one found a significant relationship (Ogilvie et al., 2010), whereas the others reported null findings for perceived severity of HPV-related disease and of cervical cancer (Conroy et al., 2009; Reiter et al., 2009). These non-significant findings and the results from the present study could be due to ceiling effects. In the present study the item 'perceived severity of cervical cancer' had a mean score of 9.4 out of 10 and so there may not have been enough variation in the data to distinguish differences between participants. The differences in findings may also be due to the measurement of perceived severity as research has considered perceived severity of HPV-specifically, HPV-disease generally and of cervical cancer. Alternatively, perceived severity may not be a useful construct to examine when considering HPV vaccination uptake, as was alluded to in Chapter 2.

Limitations

The cross-sectional nature of this study meant that that causality could not be determined. It may have been that willingness to vaccinate a daughter was informing mothers' risky sexual behaviour beliefs, rather than vice versa and this is a pragmatic interpretation of the results. Vaccination intentions may not have reflected actual behaviour; a review across a range of health behaviours showed intentions to predict no more than one third of the variance in actual behaviour (Sheeran, 2002).

All social cognition constructs (perceived risk, perceived severity and willingness to vaccinate) were measured using single items which may have resulted in measurement error and reduced the potential for variability in the data. However, single item measures of HPV vaccine acceptability for a daughter have commonly been used in previous research (for example, de Visser & McDonnell, 2008; Kahn et al., 2009; Marlow et al., 2007a) and intention to vaccinate does map on to early reports of actual vaccination uptake; for example Brabin et al. (2006) found 81% of parents to intend for their daughter to receive the HPV vaccine and Marlow et al. (2007a) reported that 75% of mothers would accept vaccination for a daughter compared with 80.1% of eligible 12-13 year olds who had actually received all three doses of the vaccine between September 2008 and August 2009 (Department of Health, 2010). Single item measures of perceived risk are also acceptable if well chosen (Weinstein et al., 2007) and the item used in this study accorded with the recommendations asserted in this paper.

In addition, a variety of response scales were used to measure the constructs. This limits our ability to compare findings between constructs. Such comparisons were made in this study and these may have been inappropriate. Response scales with a greater number of response options allows for more variability in the data than response scales with fewer response options and means that there is greater likelihood that significant effects will be detected. It is possible that significant results reported in this study were due to the choice of measurement tool; however, in all analyses the item with the greatest number of response options (perceived severity of cervical cancer) was not found to be significantly associated with the dependent variables.

Given that awareness of HPV was low the risky sexual behaviour statements may have asked mothers to respond about issues that they had not previously considered. It would be beneficial to examine mothers' beliefs about sexual behaviour and HPV now that the vaccination programme has started and mothers have had the opportunity to consider vaccination more carefully and formulate their own opinions.

The variables assessed in the present study could predict only 5% of the variance in willingness to vaccinate a daughter against HPV. Future research should attempt to identify other predictors of HPV vaccination acceptance in parents and could benefit from being informed by general models of parental immunisation decision making and social cognition models.

As with all survey methods, the sample was restricted to individuals who were available and willing to take part in this study. Only 53% of individuals originally contacted agreed to participate suggesting that the findings may not be entirely representative of British mothers with daughters who will be offered the vaccine. Quota sampling would have increased the number of participants being available for interview, but would have masked the fact that the data was unlikely to be representative. However, the proportion of White respondents and average household income of the participants was comparable with population estimates. The 2001 census showed that 91% of the UK population were White versus 90% in the present study (Office for National Statistics, 2003) and average household income was £28,854 in 2007-08 reported by the Office for National Statistics versus £27,446 in the present study (Barnard, 2009). The response rate provided could only be a guide to the actual response rate for women as gender-specific response rates were not available.

The study did not explore the beliefs of fathers. It is likely that fathers will play a role in their daughter's healthcare decisions and this study did not provide insight into their attitudes regarding HPV vaccination. In the UK the HPV information materials are being targeted at mothers only so it is likely that fathers are less aware of the immunisation programme. Primarily, an exploration into the attitudes of the individuals most likely to be

involved in the HPV vaccination programme was most appropriate. Although a number of the studies that have considered sexual behaviour and HPV vaccination have included mothers and fathers, the attitudes of fathers specifically have not been considered. In East Asian countries it is recognised that fathers play a key role in decisions about their child's healthcare, including HPV vaccination (Wong, 2009a), but the role of fathers in HPV vaccination decisions in the UK or Western world has not been examined. This is especially intriguing given the sexual nature of HPV and that adolescents, especially girls, have been shown to feel more at ease discussing sex with their mothers (DiIoro et al., 1999). It would be interesting to explore fathers' beliefs about their daughter's sexual behaviour following HPV vaccination and how this impacts on their role in vaccination decisions.

The study did not receive formal ethical approval. This is potentially harmful both for the researcher and the participants as the risks of the study were not independently assessed and is not good research practice. It was not possible to enforce ethical standards onto the external research company that collected the data, however NatCen do abide by the Social Research Association ethical guidelines.

Conclusions

This study highlighted the prevalence of mothers' beliefs about risky sexual behaviour following HPV vaccination and found some mothers of daughters under the age of 16 to agree that behaviour may change. However, the mothers' perceived risk of cervical cancer was related to their willingness to consent to HPV vaccination to a greater extent than beliefs about sexual behaviour, suggesting that sexual behaviour concerns held by a minority will not be sufficient to cause mothers to refuse consent to vaccination. Vaccination programme information materials for mothers may improve HPV vaccination acceptance if they discuss cervical cancer risk and improvements in awareness of HPV may also reduce parents' concern about their daughter's sexual behaviour following HPV vaccination. This study addressed one sexual behaviour concern that parents express about the HPV vaccination: apprehension that girls will engage in more risky sexual behaviour

following HPV vaccination because they believe that they have a reduced risk of catching an STI. It will be important to establish whether this concern is appropriate and Chapter 7 will consider whether girls have changed their sexual behaviour following HPV vaccination. Before exploring this, the second concern that parents have reported must be investigated and this is the focus of Chapter 6.

Chapter 6 - Girls' beliefs about the meanings behind their parents' HPV vaccination decisions

BACKGROUND[12]

Chapter 5 highlighted that a significant minority of parents have concern about the sexual behaviour of their daughters following HPV vaccination. This study investigated the second type of sexual behaviour concern that parents have reported about the HPV vaccine, that consent to vaccination may be perceived as implicit approval (or '*carte blanche*') for sexual activity and may encourage earlier sexual debut.

A number of studies from the USA and UK have consistently found a minority of parents express this particular concern. Waller et al. (2006) conducted focus groups with mothers of 8-14 year old daughters. They found some mothers report concern that HPV vaccination consent might imply tacit approval for sexual activity in their daughters, although others were less concerned. In another early study of Californian parents, Constantine and Jerman (2007) found some mothers report that they intended to refuse vaccination because consent would go against what they taught their daughter about not having sex before marriage. Brabin et al. (2008), in a feasibility study of the implementation of the HPV vaccination programme in the UK, asked parents to explain why they had refused to consent to vaccination for their daughter unprompted. Of parents who responded (8.1% of all non-consenters) 3% (n=4) refused the vaccine because of a concern that consent to HPV vaccination would condone sexual activity in their daughter. A study of Alaskan mothers did not find this issue to be of concern, but the women did think it may be for other mothers (Toffolon-Weiss et al., 2008). Finally, Bair et al. (2008) found 2 (out of 40) Latina mothers to report that concern about implicit encouragement of sexual activity would prevent them from vaccinating their daughter.

[12] This study was completed in November 2008. Literature available at this time which contributed to the rationale for this study is presented in the introduction. Literature published after November 2008 is introduced in the discussion section. This study was published in BJOG (Appendix 10).

As the review of the literature in Chapter 2 highlighted, a growing body of research has considered parental opinions of the HPV vaccine, however fewer studies have assessed girls' attitudes and none have asked them about the sorts of inferences they would draw from their parents' decision to consent to HPV vaccination or not. Understanding these inferences could be important because they may affect post-vaccination sexual behaviour or allay parents' concerns. A few studies have shown some girls to have made inaccurate interpretations about HPV vaccination and sexual behaviour. A systematic review of HPV knowledge conducted by Klug et al. (2008) reported that most people have a poor understanding of HPV, however, inaccurate knowledge was also evident. Some studies reported that individuals confused HPV with other STIs suggesting that vaccination recipients may incorrectly believe that the HPV vaccine affords more protection than it actually does (although all of the studies were conducted before the announcement of the development of the HPV vaccine when knowledge was likely to be low). A qualitative study of 13-27 year old women in Malaysia found that some were concerned about the message being given to others were they to decide to have the HPV vaccine: "*People will think we are sexually active"* (Wong, 2008).

Most girls appear to be in favour of receiving the HPV vaccine. Studies from the USA have reported that around 70% of girls intend to receive the HPV vaccine although early reports of actual vaccination receipt were much lower, with around 25% of 13-17 year olds being vaccinated (Caskey et al., 2008; Hoover et al., 2000; Jain et al., 2008; Kahn et al., 2008). One British study that investigated the feasibility of the HPV immunisation programme before the main programme was initiated reported that 70% of girls received the vaccine (Brabin et al., 2008).

British and American studies have reported that mothers worry that their providing consent to HPV vaccination will be regarded by their daughters as implicit consent for them to be sexually active, but research has not considered whether daughters themselves are likely to take such messages. It is possible that girls will interpret vaccination consent solely as their parents' desire to protect them from cervical cancer and such an outcome may allay parents' concerns. Alternatively if parents are correct in their beliefs about how some girls

would interpret parental HPV vaccination consent, it is important to understand these interpretations and identify ways to dispel such beliefs. This study was designed to achieve aim three of this thesis: to establish girls' views on the HPV vaccine and sexual behaviour. Using questionnaires, this was investigated by exploring the beliefs that girls had about the messages behind their parents' vaccination consent.

Three study-specific research questions were posed:

1. Do girls intend to have the HPV vaccine?
2. Do girls believe their parents will consent to HPV vaccination?
3. Would girls take implicit messages about sexual behaviour and other issues relating to HPV vaccination from their parent's consent to HPV vaccination?

In accordance with previous research it was hypothesised that girls would want to receive the HPV vaccine. Given these positive intentions and the evidence from previous studies that most parents would consent to HPV vaccination, it was predicted that girls would believe that their parents would also consent to HPV vaccination. Finally it was hypothesised that a minority of girls would take unintended messages from their parents' consenting to HPV vaccination as some evidence suggests that some have inaccurate knowledge.

METHODS

Participants

Adolescent girls in school year 10 (age 14 and 15) were recruited from a high-achieving, state-funded, single-sex secondary school in London. This population was chosen as they were due to be involved in the HPV vaccination 'catch-up' programme. The school was chosen as it had participated in research with the Health Behaviour Research Centre previously.

Procedure

The head of year 10 was contacted via telephone and asked whether their students would be able to participate in a study about the cervical cancer vaccine. They were provided with information about the study and after having an opportunity to consider the research, consented to researchers approaching their students during a tutorial lesson conducted in the school hall. The session was facilitated by two researchers who were independent to the school but teachers were also present. After reading the study information sheet, the girls read a leaflet that provided them with information about HPV, cervical cancer, the HPV vaccine, and cervical screening (see Appendix 11 for study information materials). The leaflet was developed following a series of interviews and focus groups (Marlow et al., 2008). As part of another study, participants were randomly assigned to receive the leaflet in one of two different graphical forms (the content of the leaflet was identical, see Appendix 11) to investigate whether the source of the leaflet (a pharmaceutical company or a university) affected participants' responses. Exactly half of the participants received one version of the leaflet and half received the other version. Participants were given as much time as they needed to read the leaflet; they then completed the questionnaire (Appendix 12). Participants were given an opportunity to ask questions after completing the questionnaire. Questionnaires were used as they were considered an effective way of quickly collecting information that could be elicited using multiple choice options. Collecting data in school was the most appropriate location for the research to be conducted as all girls of the age range under consideration should have been in full-time education, testing conditions could be monitored by the researcher and questionnaires would be returned immediately. The study was approved by the UCL research ethics committee (see Appendix 13), the school provided proxy consent for parents and all participants provided informed consent.

Measures

The questionnaire assessed demographic characteristics (age, ethnicity, religion and whether they were practising that religion), HPV knowledge and two vaccine-related issues: HPV vaccination intentions and perceptions of the meanings behind parents' HPV vaccination consent in terms of sexual behaviour and other issues relating to HPV vaccination.

Beliefs about the meanings behind parents' HPV vaccination consent

The items assessing adolescents' perceptions of the meanings behind parents' HPV vaccination consent were designed to find out what girls think of the beliefs that parents have been shown to hold about HPV vaccination in previous studies. These items were developed based on parental beliefs about HPV vaccination elicited in focus groups and a quantitative survey (Marlow et al., 2007a; Waller et al., 2006). The items developed in the present study isolated these beliefs and were piloted with a small opportunistic sample to ensure that they were easy to understand. The items asked participants to respond to seven statements assessing what they thought it would mean if their parents allowed them to have the HPV vaccine (responding on a five-point scale from 'strongly disagree' to 'strongly agree'). An example statement was provided for participants to read before responding to the main statements to give them an opportunity to check they understood the type of question being asked. Beliefs about sexual behaviour were examined in four statements (e.g. 'If my parents let me have the HPV vaccine they would be concerned that I might have sex earlier'), and three statements examined beliefs about other issues relating to HPV vaccination (e.g. 'If my parents let me have the HPV vaccine I would know that they agreed with vaccinations in general').

Vaccination intentions

Vaccination intentions were assessed by asking participants to indicate their own intention to receive the HPV vaccine using a four-point scale ('when you are invited to have the HPV vaccination, how likely would you be to have it?', response 'very unlikely' to 'very likely'), that was adapted from the structure used by Orbell, Hodgkins and Sheeran (1997). A forced-choice scale was used as it was predicted based on previous research that awareness of HPV would be low. A review of HPV knowledge reported that on average 17% of children under the age of 18 had heard of HPV (Klug et al., 2008). As a result, participants would have been likely to use the middle 'not sure' option. To increase the variability in responses a middle option was not used. Participants were also asked 'do you think that your parents would let you have the HPV vaccine?' ('no', 'not sure', 'yes').

Knowledge of HPV

Knowledge of HPV was assessed by asking participants whether 18 statements about HPV and the vaccination were 'true' or 'false' (an option for 'don't know' was provided here); a total knowledge score was derived by summing the number of correct responses. The question items had been previously developed following a literature search of items that had been used to assess knowledge about HPV. These items were categorised into broad themes and items from each theme were selected for use to assess knowledge of HPV in the present study. The information leaflet provided to participants directly addressed 11 of the knowledge questions, indirectly addressed five of the questions and did not address two of the questions.

Analysis

Data were analysed using SPSS 14 for Windows and STATA SE 11.0 for Windows (SPSS Inc., 2005; StataCorp LP, 2009). Too few participants identified themselves as belonging to some ethnic and religious groups to make statistical comparisons. These groups were grouped together and labeled as 'other'. The creation of an 'other ethnicity' and 'other religion' group meant that inferences could not be made about these groups specifically, only comparisons made with them. Age was treated dichotomously as only two responses were given in the year group participating in the study (age 14 and 15). Analysis using the variable 'practising a religion' only included respondents who already identified themselves as having a religion in a previous question.

Effect sizes reported in previous studies of adolescents' beliefs about HPV vaccination were used to help establish the sample size necessary for the study, one of these studies was unpublished at the time of the present study (Kahn et al., 2008; Marlow et al., 2009). Using the average significant effect reported in these studies (f^2=.25), conventional alpha and power estimates (alpha=.05 and power=.8) and anticipating analysis using a maximum of three groups, it was determined using GPower that 159 participants would be needed to detect significant effects (Faul et al., 2007). There were approximately 200 students registered in school year 10 at the school used to recruit the participants so it was appropriate to sample from one school only. None of the potential participants refused to

complete the survey but 11 cases were excluded due to large amounts of missing data (>50%) leaving responses from 162 girls to be included in the analysis. Additional missing values were dealt with by performing missing values analysis using the expectation-maximisation algorithm on continuous variables as described in Chapter 5. The percentages of missing responses computed for each variable have been presented in Appendix 14.

Preliminary analysis demonstrated that the data was not normally distributed; skewness and kurtosis for the main variables were at unacceptable levels, this was resolved using log transformations. The non-transformed data were presented for descriptive purposes to make the interpretation simpler but inferential statistics used the transformed scores. In cases where Levene's tests showed the variance in the data to be heterogeneous non-parametric tests were run as well as parametric tests. The results of the parametric tests were presented unless the two types of test differed in their results.

To test whether relationships existed between the demographic and knowledge variables Fisher's chi-square statistic was used for analysis of two categorical variables and independent t-tests or ANOVAs to establish differences between categorical and continuous variables. Significant differences between these variables were adjusted for in subsequent analysis. To test for differences and relationships between the girls' own HPV vaccination intentions and the knowledge/demographic variables ANOVAs, independent t-tests, two-way Pearson's correlations and ANCOVAs were performed. To test for differences between the girls' beliefs about whether their parents would consent to HPV vaccination and the knowledge/demographic variables ANOVAs, Fisher's chi-square statistic and ordinal regressions were performed. To test for relationships between the girls' beliefs about the meanings behind their parents' vaccination consent and the knowledge, demographic and vaccination intention variables two-way Pearson's correlations were performed for analysis of only continuous data and independent t-tests, ANOVAs or ANCOVAs were performed for analysis of continuous and categorical variables. Cramer's V was used as an effect size for Fisher's chi-squared statistic and Pearson's r for all other statistics. As there were a large number of items assessing

perceptions of meaning behind parents' HPV vaccination consent, analysis of these items required multiple comparisons to be made which could have resulted in type 1 errors being committed[13]. To reduce the likelihood of this occurring, a significance level of $p \leq .01$ was accepted for analysis of these items. Post-hoc effect size calculations demonstrated 80% power for Pearson effect sizes larger than .22. There were no significant differences between groups based on which leaflet was read (data not presented) therefore all data were analysed together.

My role in this study

This study was conceived and designed by myself with Professor Wardle, Dr Waller and a colleague Mr Gareth Lloyd. Mr Lloyd was conducting research on a related topic, developing HPV vaccine information and so the data collection for our studies were combined. I developed the measures for the study in discussion with Dr Waller and Mr Lloyd. I gained ethical approval for this study; including writing a detailed protocol, consent form and questionnaires for data collection. Dr Marlow, Dr Waller and Mr Lloyd prepared the written information materials. Mr Lloyd and I performed the data collection together. I entered the majority of the data myself and analysed the data. Mr Boniface and Dr Waller provided input on the analysis. I wrote this study up for publication in collaboration with Dr Waller and Dr Marlow.

RESULTS

The girls had an average age of 14.6, most identified themselves as White and of a Christian religious denomination (Table 6.1). Of those who reported a religion 63.9% were not practising it. Knowledge of HPV was good (mean=12.0 out of 18; Table 6.2), although this is likely due to the girls receiving the information leaflet prior to completing the questionnaire rather than previous awareness.

Differences and relationships between groups were found for the independent variables and these were adjusted for in subsequent analysis. Ethnicity was related to religion

[13] Acceptance of the alternative hypothesis when the null hypothesis should have been accepted.

($\chi^2(6)=82.12$, $p<.01$, $V=.61$) and whether an individual reported that they were practicing a religion ($\chi^2(2)=15.21$, $p<.01$, $V=.43$). Religion was related to whether an individual reported practicing that religion ($\chi^2(2)=8.81$, $p=.01$, $V=.32$). See Appendix 14 for analysis tables showing tests of differences and relationships between the independent variables and Appendix 15 for bar graphs showing the direction of the significant differences.

Table 6.1 – Demographic characteristics of the sample (n=162)

	n (%)
Age	
14	66 (40.7)
15	96 (59.3)
Ethnicity	
White	118 (72.8)
Asian	18 (11.1)
Other	17 (10.5)
Missing	9 (5.6)
Religion	
None	36 (22.2)
Christian	74 (45.7)
Muslim	15 (9.3)
Other	8 (4.9)
Missing	29 (17.9)
Practising this religion	
Yes	26 (26.8)
No	62 (63.9)
Missing	9 (9.3)
In general, do you think that your parents would let you have the HPV vaccine?	
Yes	116 (71.6)
No	6 (3.7)
Not Sure	24 (14.8)
Missing	16 (9.9)

Table 6.2 – Vaccination intentions, knowledge of HPV and perceptions of the meanings behind parents' HPV vaccination consent for untransformed data

N=162	n (%)
If you were invited to have HPV vaccination, how likely would you be to have it?	
Very unlikely	7 (4.3)
Unlikely	8 (4.9)
Likely	74 (45.7)
Very likely	73 (45.1)
Knowledge of HPV; mean (sd)	12.0 (3.8)
If my parents let me have the HPV vaccine they would be concerned that I might have sex earlier	
Strongly disagree	37 (22.8)
Slightly disagree	55 (34.0)
Unsure	38 (23.5)
Slightly agree	28 (17.3)
Strongly agree	4 (2.5)
If my parents let me have the HPV vaccine they would be concerned that I might have unprotected sex	
Strongly disagree	35 (21.6)
Slightly disagree	65 (40.1)
Unsure	30 (18.5)
Slightly agree	27 (16.7)
Strongly agree	5 (3.1)
If my parents let me have the HPV vaccine it would mean that they think that I am old enough to have sex	
Strongly disagree	32 (19.8)
Slightly disagree	71 (43.8)
Unsure	47 (29.0)
Slightly agree	9 (5.6)
Strongly agree	3 (1.9)

Table 6.2 continued

N=162	n (%)
If my parents let me have the HPV vaccine I would know that they think it is ok for me to be sexually active	
Strongly disagree	23 (14.2)
Slightly disagree	78 (48.1)
Unsure	45 (27.8)
Slightly agree	12 (7.4)
Strongly agree	4 (2.5)
If my parents let me have the HPV vaccine it would mean that they wanted to protect me against sexually transmitted infections	
Strongly disagree	2 (1.2)
Slightly disagree	4 (2.5)
Unsure	26 (16.0)
Slightly agree	87 (53.7)
Strongly agree	43 (26.5)
If my parents let me have the HPV vaccine it would mean that they wanted to protect me from cervical cancer	
Strongly disagree	2 (1.2)
Slightly disagree	3 (1.9)
Unsure	14 (8.6)
Slightly agree	92 (56.8)
Strongly agree	51 (31.5)
If my parents let me have the HPV vaccine I would know that they agreed with vaccinations in general	
Strongly disagree	3 (1.9)
Slightly disagree	17 (10.5)
Unsure	54 (33.3)
Slightly agree	70 (43.2)
Strongly agree	18 (11.1)

Intention to receive the HPV vaccine and beliefs about parents' intentions to consent to HPV vaccination

Intentions to receive the HPV vaccine were strong (see Table 6.2 and Table 6.3 for transformed scores). Around 91% thought that it was likely or very likely that they would have the vaccine and 72% believed that their parents would let them have the vaccine (Table 6.2 and Table 6.3 for transformed scores). Knowledge of HPV was related to the girls' intentions with higher knowledge associated with stronger intentions to receive the vaccine ($r=.31$, $p<.01$). No other independent variables were related to whether girls intended to have the HPV vaccine and no independent variables were associated with the girls' beliefs about whether their parents would let them have the vaccine (see Appendix 14 for all non-significant effects).

Table 6.3 – Vaccination intentions, knowledge of HPV and perceptions of the meanings behind parents' HPV vaccination consent for transformed data

N=162	Transformed mean (sd)
Knowledge (0-1.3) [a]	1.1 (0.23)
If you were invited to have HPV vaccination, how likely would you be to have it? (0-.6) [a]	0.5 (0.13)
If my parents let me have the HPV vaccine they would be concerned that I might have sex earlier (0-.7) [a]	0.3 (0.22)
If my parents let me have the HPV vaccine they would be concerned that I might have unprotected sex (0-.7) [a]	0.3 (0.21)
If my parents let me have the HPV vaccine it would mean that they think that I am old enough to have sex (0-.7) [a]	0.3 (0.19)
If my parents let me have the HPV vaccine I would know that they think it is ok for me to be sexually active (0-.7) [a]	0.3 (0.18)
If my parents let me have the HPV vaccine it would mean that they wanted to protect me against sexually transmitted infections (0-.7) [a]	0.6 (0.11)
If my parents let me have the HPV vaccine it would mean that they wanted to protect me from cervical cancer (0-.7) [a]	0.6 (0.1)
If my parents let me have the HPV vaccine I would know that they agreed with vaccinations in general (0-.7) [a]	0.5 (0.13)

[a] Information in brackets indicates the possible range for transformed scores

Perceptions of the meanings behind parents' HPV vaccination consent

A minority of participants slightly agreed or strongly agreed that parental consent to HPV vaccination implied that they were old enough to have sex (7%, Table 6.2 and Table 6.3 for transformed scores) and 10% slightly agreed or strongly agreed that it was okay for them to be sexually active. A minority slightly agreed or strongly agreed that that if their parents consented to vaccination they would be concerned that their daughter might have unprotected sex (20%) or reach sexual debut earlier (20%). However, most girls would take positive health messages from parental consent to HPV vaccination, seeing such consent as indicating general approval of vaccinations (54% slightly agreed or strongly agreed that this was the case) and a desire to protect their daughter against cervical cancer (88% slightly agreed or strongly agreed) and STIs (80% slightly agreed or strongly agreed).

Girls with stronger intentions to receive the HPV vaccine were more likely to believe that consent to vaccination implied that they were old enough to have sex ($r=.19$, $p=.01$). None of the items assessing perceptions of the meanings behind parents' HPV vaccination consent were related to whether the girls believed their parents would consent to vaccination (see Appendix 14 for all non-significant effects).

Girls with higher knowledge scores were more likely to believe that consent to vaccination implied that parents wanted to protect their daughters against cervical cancer ($r=.27$, $p<.01$) and STIs ($r=.22$, $p<.01$) and were less likely to believe that their parents would be concerned about unprotected sex ($r=-.17$, $p=.03$), although this finding was only approaching significance.

Practising a religion was also related to the belief that parents who consent to HPV vaccination may be concerned about unprotected sex in their daughters ($F=6.72$, $p=.01$, adjusted $r=.06$; adjusted mean for those who were practising a religion .41 vs. .26 for those who were not) with girls who reported practising a religion being more likely to hold these beliefs. Practising a religion was also related to the belief that parents who consent to HPV vaccination may be concerned that their daughter may have sex earlier ($F=5.25$, $p=.03$,

adjusted r=.07; adjusted mean for those who were practising a religion .41 vs. .29 for those who were not) with girls who reported practising a religion being more likely to hold these beliefs; again this effect was only approaching significance.

No other statistically significant relationships or differences existed for comparisons with the independent variables (demographic characteristics, HPV knowledge, the girls' own HPV vaccination intentions and whether they thought their parents would consent to HPV vaccination) and the dependent variables (perceptions of the meanings behind parents' HPV vaccination consent; see Appendix 14 for non-significant results).

DISCUSSION

This questionnaire study explored girls' HPV vaccine intentions, perceived parental attitudes, and beliefs about the meaning behind parents' HPV vaccination consent. The study was conducted following reports of parents being concerned that their consent to HPV vaccination would be perceived by their daughters as implicit approval to engage in sexual activity (Bair et al., 2008; Brabin et al., 2008; Constantine & Jerman, 2007; Toffolon-Weiss et al., 2008; Waller et al., 2006). Since the present study was performed similar concerns have continued to be expressed in three American and two Malaysian studies. Wong (2009b) conducted focus groups with Malaysian mothers, fathers and vaccine-eligible girls. Participants considered it important that the HPV vaccine should not be labelled solely as an STI vaccine as it could put parents in the position of condoning premarital sex and Sam, Wong, Rampal, Leong and Pang et al. (2009) found 33% of Malaysian mothers who were unwilling to vaccinate their daughter reported that this was because of concern that the vaccination will encourage sexual activity in their daughter, but this was lower in an American study of largely Latino parents of daughters even when this was provided as a response option to explain why they had refused the HPV vaccine for their daughters (8%; Yeganeh et al., 2010). However, this belief was higher in another American study of mothers of whom 15% expressed concern that HPV vaccination consent implies approval for sexual activity when they were given this response as an option for why they said they would refuse or had refused vaccination for their daughter (Podolsky et al., 2009). One final American study found a few low-income minority mothers of 11-18

year old daughters report in a qualitative study that they were fearful that their daughters would '*misinterpret [vaccination as] a green light to have sex, a form of permission*' (Perkins et al., 2010). One mother even said that she would not fully inform her daughter about the HPV vaccine because of this reason.

In the present study beliefs about vaccination decisions were broadly positive with most girls expressing strong intentions to receive the vaccine and believing that their parents would consent. Most girls reported that they would infer positive messages about vaccination and other HPV vaccination-related issues if their parents consented to vaccination. The statements that almost all girls agreed with were that being allowed the HPV vaccine meant that their parents wanted to protect them against cervical cancer and STIs. Most girls did not believe that vaccination consent implied approval for them to be sexually active. Parents concerned about negative changes in sexual behaviour following vaccination may be reassured by this, and feel happier about consenting to their daughters having the vaccine.

However, a small number of girls would perceive implicit approval for sexual activity if they were allowed the vaccine. These beliefs reinforced concerns previously expressed by parents and highlight the importance of parent-daughter communication about sex. Of further concern was the finding that girls with stronger intentions to receive the vaccine were more likely to perceive that parental consent to vaccination implies that the recipient is old enough to have sex.

Although other research has not considered the messages that adolescents may interpret from being allowed the HPV vaccine, research published after the present study was conducted has partially supported the validity of parents' concerns as it also suggested that adolescents are holding a range of inaccurate beliefs about HPV vaccination and sexual behaviour. A study from the USA found 13-18 year old girls misinformed about the protection offered by the HPV vaccine with around 43% believing the vaccine affords protection against chlamydia and gonorrhoea and 15% believed that it was not possible to be infected with an STI after receipt of the vaccine (Mathur et al., 2010). Similar findings

were reported in an Australian qualitative study conducted after the initiation of a national immunisation programme with girls confusing HPV with other STIs and some believing that they were protected from STIs generally, pregnancy and completely protected from cervical cancer after receiving the vaccine (Robbins et al., 2010).

Taken together, the findings from previous research and the current study are worrying and have implications for the sexual behaviour and future cervical screening practices of girls who may believe that they are now protected from STIs generally, HPV infection, cervical cancer and even pregnancy. However, the present study was small and the pre-defined items may have primed the girls to agree with issues that they had not previously considered. Even if the findings were genuine, they may have been due to the cross-sectional nature of the data; it may be that girls who felt that they were ready to have sex were more likely to intend to have the vaccine. Additionally, even if girls believe that they have been given '*carte blanche*' to be sexually active, this does not mean that they will necessarily become sexually active. Further study of girls' response to these items in alternative settings and assessment of their freely recalled beliefs about the HPV vaccine is needed. Some girls did appear to be confused about this vaccine and may benefit from talking to their parents or a healthcare professional about it.

Practicing a religion appeared to be related to the belief that if parents consented to vaccination they may be concerned about unprotected sex and earlier sexual debut. Girls who were practising a religion may have believed that the protection afforded by the HPV vaccine overrides/lessens the requirements of their religion regarding sexual behaviour. It is likely that girls who are practising their religion have parents who are also practising and it appears that these girls believe their parents will be concerned about their daughter's sexual behaviour for religious reasons.

However, the finding that the statements of perceptions of the meanings behind parental HPV vaccination consent regarding sexual behaviour were not related to whether girls believed that their parents would consent to vaccination themselves is reassuring. It appears that although parents who are practising a religion may be concerned about the

HPV vaccine relating to sexual behaviour, girls did not believe that this concern would be great enough for them to refuse vaccination for their daughters. More detailed exploration of this issue is required. Three of the four published studies that have considered religiosity have found more highly religious parents to be less likely to intend to consent to HPV vaccination (Barnack et al., 2001; Constantine & Jerman, 2007; Natan et al., 2010) although one large Canadian study reported null findings (Ogilvie et al., 2010). It may be beneficial to consult religious community leaders when deciding how best to communicate information about the vaccine as it appears that issues relating to one's religious beliefs are influencing vaccination beliefs, although not to an extent that warrants undue concern.

Identifying oneself as having a religion was not related to girls' beliefs about their parents' concern about sexual behaviour. This suggests that active participation in a religion as opposed to affiliating oneself with one's parents' religious beliefs or cultural upbringing is a better indicator of whether religion will influence beliefs and behaviour. Alternatively it may have been that this analysis was inadequately powered to detect differences as there were too few participants in each religious group.

Although the vaccination is being presented in the UK as a vaccination against cervical cancer, the sexually transmitted nature of the virus is referenced in information leaflets designed for girls and McRee et al. (2010) in a conference proceeding reported that 47% of parents who discussed the HPV vaccine with their daughter said that this led to a conversation about sex. Parents may feel more confident that vaccination will not influence their daughter's sexual behaviour if they were provided with guidance in how to have conversations about sex with their daughters and were helped to explain why the vaccine is being given. Vaccination programme coordinators must ensure that information materials highlight both the reason that the vaccine is being given before the onset of sexual activity and that girls do not have to wait until they are ready to have sex before having the vaccine (as is the case in the current leaflet used by the NHS in Northern Ireland). Discussions with daughters could be facilitated by engaging them in the decision making process about whether to receive the HPV vaccine and this is in line with Article 12 of the UN convention on the rights of the child which states that children have a right to be involved in decisions

that affect them (Office of the United Nations High Commissioner for Human Rights, 1989). There is evidence that parents are willing to do this or are doing so already (Brabin et al., 2007; Breitkopf et al., 2009; Mathur et al., 2010).

As has been found in previous UK studies of vaccine acceptance (Marlow et al., 2009), girls' own HPV vaccination intentions were strong and most believed their parents would let them have the vaccination. This appears to be the case from initial reports of actual vaccination uptake in 12-13 year old girls (Department of Health, 2009). Knowledge of HPV was good suggesting that girls' awareness of HPV is improving from earlier assessments conducted after the development of the vaccine; previously Kahn et al (2008) found that girls assessed in 2006-07 could on average accurately respond to 40% of questions about HPV and Marlow et al. (2009) reported that only 6% of 16-19 year olds surveyed in 2007 had heard of HPV. However, the improved knowledge scores shown in the present study may have just reflected the fact that information was provided to respondents before they completed the knowledge measure. Positive associations reported between willingness to receive the vaccine and knowledge, and relationships between beliefs about the meaning behind parents' vaccination decisions and knowledge, might have been a result of greater engagement in the study rather than higher knowledge per se. Girls who read the leaflet more carefully are likely to have gained a greater knowledge and consequently more clearly recognise the benefits of HPV vaccination and have attitudes that reflect this.

Similarly to previous studies examining girls' intentions to receive the vaccine (Kahn et al., 2008; Marlow et al., 2007a; Ogilvie et al., 2007; Woodhall et al., 2007), knowledge of HPV was associated with intentions to receive the vaccine and girls with higher knowledge were more likely to take positive messages about the vaccine from being allowed it. These findings suggest that by increasing knowledge girls could be more likely to intend to receive the vaccine which could increase vaccination uptake. The findings are mixed regarding changes in vaccination acceptance following the provision of HPV information; such intervention studies have not been performed with girls and even in adults have looked at intentions to consent to vaccination rather than actual vaccination rates. Chan, Cheung,

Lo and Chung (2007) found improved acceptance and self-perceived knowledge in parents after they received a pamphlet about the vaccine, and although not reporting changes in knowledge, Gillespie, Banas, Tang, Worley and Rome (2008) improved acceptance of the vaccine in previously undecided parents after they received an HPV information sheet. Similarly, Davis, Dickman, Ferris and Dias (2004) found an educational fact sheet to improve acceptance rates in parents who were originally opposed to or undecided about vaccination, but they did not find knowledge to be associated with acceptance. Dempsey, Zimet, Davis and Koutsky (2005) did not find parents' vaccine acceptability to relate to whether they received an HPV information sheet or not, although knowledge was higher in those who received the information sheet.

In contrast to the findings of the literature review in this thesis ethnicity was not related to intentions to receive the vaccine. However, this may because group sizes were too small for difference to be detected and the study was not powered to explore ethnicity. It would be worthwhile to examine demographic predictors of vaccination acceptance in a larger sample. In concordance with the findings of the literature review in Chapter 2, religion, whether the girls were actively practising a religion and age were not significantly associated with girls' intentions to receive the HPV vaccine

The girls in the present study were slightly older than the cohort receiving the vaccine as part of the standard immunisation programme; however this age group have been included in the 'catch-up' series. Girls in this older age group are more likely to have begun engaging in sexual relationships than 12-13 year olds in the main immunisation programme (26% of girls have sex before age 16, Wellings et al., 1990) and it could be argued that girls who are already sexually active are more liable to change their sexual behaviour following HPV vaccination. Thus this study examined and improved understanding of issues relating to sexual behaviour in an appropriate age group. Additionally, girls who receive the vaccine as part of the routine immunisation programme will grow up knowing that they are protected against HPV and it is important to understand how recipients of the vaccine interpret HPV vaccination in older adolescence (even if they did receive it a few years previously).

Limitations

The participants of this study attended a high-achieving, secondary school, the majority were White and only 9% of pupils were entitled to free school meals which is below the average (13.6%) for England (Department for Education and Skills, 2006). This may limit how representative the results are for British girls in general. The rest of the population may have lower vaccination intentions given that parents in high SES groups tend to be more likely to consent to HPV vaccination (Brabin et al., 2008; Chao et al., 2009a; Chao et al., 2009b). The study was inadequately powered to detect between-group differences smaller than r=.22 which will have increased the possibility that significant results may have been missed. The measures assessing girls' perceptions of meanings behind their parents' HPV vaccination consent were not formally validated and the girls may have been confused with the conditional – 'if X then Y' – nature of the questions (e.g. having to imagine their parents' beliefs whilst imagining that their parents would allow them to have the vaccine) although an example question was provided to participants before they responded to the items. Future research must assess how reliable these statements are over time. The girls' intentions were assessed hypothetically in the present study and may not reflect vaccination behaviour. Additionally, girls may have had inaccurate beliefs about their parents' vaccination intentions, although the findings of this study are comparable to other British studies assessing parental vaccination intentions (Brabin et al., 2006; de Visser & McDonnell, 2008; Marlow et al., 2007b; Marlow et al., 2007a; Marlow et al., 2008). The present findings must only be used as a guide to prepare immunisation programme coordinators for potential issues that may arise.

Information provided to participants prior to completing the questionnaire provided answers to the majority of the knowledge questions and the mean knowledge score reflected this. However, the full range of possible knowledge scores were found during analysis and there remained enough variability in the knowledge scores for knowledge of HPV to be associated with beliefs about the meaning behind parents' HPV vaccination decisions and girls' own intentions to receive the HPV vaccine.

Conclusions

This study provided an insight into the beliefs of adolescent girls who were due to receive the HPV vaccine as part of the 'catch-up' programme. The majority of the girls intended to be vaccinated, and would infer positive messages if their parents consented to them having the vaccination. A minority of the girls would infer negative messages about their sexual behaviour from being allowed the vaccine. Accordingly it is necessary to investigate adolescent sexual behaviour following HPV vaccination to explore whether mothers' concerns described in this chapter, their concerns shown in Chapter 5 and girls' own beliefs are reflected in girls' behaviour and this was the focus of Chapter 7. Education may improve acceptance of the vaccine by girls and counter inaccurate beliefs that some girls hold. It may be beneficial for religious groups to be involved in the design of such programmes.

Chapter 7 – The impact of HPV vaccination on risk perceptions, sexual behaviour, communication about sex with parents and intentions to attend for cervical screening in the future

BACKGROUND[14]

It has been proposed in this thesis that some mothers report concern about HPV vaccination and the influence it may have on their daughters' sexual behaviour. Until now, in the UK at least, because of the novelty of the HPV immunisation programme it has not yet been possible to investigate whether girls are likely to change their behaviour following HPV vaccination. The two studies reported in this chapter were the first to explore the impact of HPV vaccination on girls' behaviour.

The impact of risky sexual behaviour

Were girls' sexual behaviour to change, mothers would be right to be concerned as it is widely recognised that sexual behaviours influence STI acquisition and pregnancy. In 2005 it was estimated that over 50,000 young women under the age of 20 in England had children (Department for Children Schools and Families, 2007), although rates of conception in both under-16s and under-18s are falling (Department for Children Schools and Families, 2010b). Teenage mothers and their children suffer poorer physical and mental health, well-being and economic status, although this is confounded by teenage mothers being most likely to come from deprived backgrounds (Department for Children Schools and Families, 2007). The UK government recognises that having a baby when a girl is young can represent a positive time in her life but has also published a formal strategy to reduce incidence of teenage pregnancy (Department for Children Schools and Families, 2010a).

[14] The studies reported in this chapter were conceived and designed in September 2008. Data collection occurred in March 2009, September-November 2009 and March 2010. Data analysis was completed in June 2010.

STIs, as their name indicates, are primarily transmitted via sexual contact. They can be caused by bacterial infections (such as chlamydia and gonorrhoea), virus infections (such as genital herpes and HPV) or parasites (for example vaginal trichomoniasis). STIs are the leading cause of preventable infertility and can lead to complications in pregnancy (World Health Organisation, 2010). Some infections result in long-term illness or untimely death (HPV, HIV), whilst others cause less severe but undesirable symptoms (for example blistering and pain in the case of genital herpes and itching and pain in genital warts). There was an increase in the number of most STIs diagnosed at genitourinary medicine clinics in the UK from 1998 to 2008, although this figure may reflect increased awareness of access to clinics in the population, greater clinic availability and enhanced sensitivity of tests rather than an overall increase in STI incidence. Diagnosis is most common in 16-24 year olds with chlamydia being most frequently diagnosed (Health Protection Agency, 2008).

A number of sexual behaviours can help reduced the likelihood of STI acquisition and unplanned pregnancy, as recognised by the National Institute for Health and Clinical Excellence (NICE, 2007), and the two studies reported in this chapter considered four behaviours and how they related to HPV vaccination receipt: consistent condom use, minimising the number of sexual partners, delaying sexual debut[15] and abstinence. Parent-daughter communication about sex and cervical cancer screening attendance intentions were also considered in the context of HPV vaccination.

The influence of psychosocial factors on sexual behaviour and parent-child communication about sex

Some of the psychosocial factors that influence sexual behaviour in young people have been identified. A systematic review of the American literature by Buhi and Goodson (2007) identified consistent correlates of early sexual debut, ever having had sex, being currently sexually active, number of sexual partners, intercourse frequency and heterosocial

[15] There is evidence that earlier sexual debut impacts on future sexual health outcomes, for example girls who reach sexual debut before age 16 are more likely to be mothers or to have an abortion before age 18 (Wellings et al., 2001).

risk (engaging in an increasing number of risky sexual behaviours). Intention was the most stable predictor of sexual behaviour and was associated with sexual debut, being currently sexually active and heterosocial risk. The amount of time adolescents reported being left home alone (or alone with a member of the opposite sex) reliably related to having ever had sex and earlier sexual debut. Perceived norms were also influential with perceptions of parental disapproval of engaging in sexual intercourse correlating with lower frequency of intercourse, higher chance of abstinence and fewer heterosocial risks. Finally, adolescents who perceived that their peers were not in favour of adolescent sexual activity were less likely to intend to have sex, were more likely abstinent and to delay sexual debut. However, the studies in this review were often cross-sectional, relied on convenience samples and employed simplistic analytical strategies that did not explore the complex nature of adolescent sexual behaviour.

Qualitative research has supported some of the findings of Buhi et al. and has introduced new concepts for consideration. Marston and King (2006), in a systematic review of qualitative research identified the key themes that are important when conceptualising adolescent sexual behaviour. Firstly, young people weigh up the risks of engaging in sexual relations with an individual based on how 'clean' they perceive they are and this also has an influence on their decision to use condoms. For women, carrying a condom can be stigmatising, indicating that she is expecting sex, and a woman can be seen as not trusting her partner or believing him to be unclean if she were to propose that condoms be used. There are gender stereotypes and norms associated with sexual behaviour. Women are expected to not be highly sexually active. There are rewards and penalties for complying with these norms and young people highly value their reputations linked to these norms regarding their sexual behaviour. It may be the case that in some cultures a woman can be stigmatised for having 'too many' sexual partners or reaching sexual debut 'too early' and others may feel that they receive the reward of group membership by remaining abstinent. These expectations, norms, rewards and penalties impede communication about sex, making it difficult for girls to suggest that a condom is used or that sexual debut is postponed. Finally, the attitudes and behaviours of sexual partners are highly influential in affecting sexual behaviour. Sexual pleasure will also likely have a significant impact

(Marston & King, 2006), although this qualitative research has not considered sexual pleasure.

In addition to what systematic reviews have concluded are influential in informing adolescent sexual behaviour, it may also be beneficial to consider parent-child communication about sex. HPV vaccination may provide a 'teachable moment' for parents to talk to their daughters about sex (Askelson et al., 2010). Parent-child communication about sex has shown to reduce the likelihood of children engaging in risky sexual behaviour. DiIorio, Pluhar and Belcher (2003) in a systematic review found mother-daughter communication about sex tended to be associated with increased condom use. Similarly, communication about HIV/AIDS risk behaviours (such as multiple partners or condom use for the prevention of HIV specifically) was associated with adolescents engaging in fewer HIV-risk behaviours. The findings were inconclusive regarding parent-child communication about sex and delayed sexual debut and, similarly to Buhi et al.'s review there was no clear evidence for the order of events as data were cross-sectional. A more recent review of longitudinal studies found that parents' communication about sexual values was associated with delayed sexual debut until age 16 or later but that these findings may not generalise to all populations (Zimmer-Gembeck & Helfand, 2008). It may also be that the kind of families that talk about sex are different from those who do not, and that these other factors explain sexual debut. There is also evidence that communication style contributes to whether these behaviours are engaged in (Diiorio et al., 2003), and the content of the communication and when or how frequently it occurs are also important to consider.

The impact of HPV vaccination on sexual behaviour

The two studies reported in this chapter were designed to address the fourth aim of this thesis - to examine the effect of participation in the HPV immunisation programme on sexual behaviour. Risk perceptions, communication about sex with parents and cervical cancer screening attendance intentions for the future were also considered. Participants were older girls participating in the HPV 'catch-up' programme. The findings of these

studies may have implications for STI acquisition and unplanned pregnancy[16] and aimed to provide a response to parents' concerns about changes in their daughters' sexual behaviour following HPV vaccination. These were the first such studies as there was no existing evidence of behaviour or attitudinal change following HPV vaccination. As a result it was deemed beneficial to consider what has been reported about the *potential* effect of the vaccine on sexual behaviour in the context of what is already known to influence adolescent sexual behaviour, or theorised as influencing their sexual behaviour.

As explained in Chapter 3, risk compensation theory and psychological behaviour-motivation and risk-reappraisal theories would suggest that changes in perceptions of risk may result in adolescents engaging in increasingly risky sexual behaviour following HPV vaccination. As detailed in Chapter 3 there is evidence of risk perceptions reducing following the adoption of risk reduction interventions. Brewer, Cuite, Herrington and Weinstein (2007b) in their Lyme disease vaccination study found perceptions of risk lowered in the vaccinated group (below the levels of the unvaccinated group) and individuals who had been vaccinated were found to perform two of five Lyme disease protective behaviours less often than before their vaccination (using tick repellent and wearing light-coloured clothing). There is currently no prospective data considering risk perceptions predicting HPV vaccination receipt or change in risk perceptions following HPV vaccination and the subsequent impact on behaviour. A cross-sectional study conducted in the USA reported that there was no association between being sexually active and completion of the HPV vaccination series and a prospective American study found no relationship between age of sexual debut and receipt of the HPV vaccine or number of sexual partners and vaccination receipt (Conroy et al., 2009; Neubrand et al., 2009). One other study of vaccination intentions found that sexually active American girls who were on average 15 years old were 2.2 times more likely to intend to receive the HPV vaccine than girls who had not reached sexual debut (Read et al., 2010). However these studies tell us nothing about causation due to their cross-sectional nature nor do they inform us about

[16] Unplanned pregnancy as a result of condoms not being used rather than due to non-use of other contraception devices, failure of contraception (including condoms) and planned pregnancy.

changes in behaviour, for example Conroy et al. did not control for average number of sexual partners in vaccinated girls before they were vaccinated.

It was concluded in Chapter 3 that behaviour change would only be feasible in accordance with the theory if certain conditions were present: if the vaccine is perceived effective, if the vaccine is visible to the girls, if girls are motivated to change, if girls have control over their current behaviour (Hedlund's four criteria), if the girls misinterpret the protection afforded by the vaccine to include all STIs, and will more likely cause girls who are already sexually active prior to vaccination to reduce their condom usage or increase their number of sexual partners (rather than virgins initiating sexual relationships).

There is some evidence from a Swedish questionnaire study that some individuals may feel an increased sense of security if they received the HPV vaccine (Gottvall et al., 2009). The 15-16 year old male and female high-school students in this study believed that they would have reduced intentions to use condoms with a new partner if they received the HPV vaccine. Brabin, Stretch, Roberts, Elton and Baxter et al. (2010) spoke to 553 12-13 year old British girls from a number of schools who had been offered vaccination (94% had received the vaccine). Prior to being offered the vaccine the girls watched an educational film about cervical cancer and HPV vaccination and were questioned six months later. The girls lacked knowledge about HPV and the vaccine and some held inaccurate beliefs. Around 13% believed that they might take more risks because they were protected against HPV, and none of the girls could recall information given to them about the uncertain protective effect of condoms on HPV acquisition. In contrast, Short et al. (2010) found that some older adult women believe they would engage in safer sexual behaviour following HPV vaccination because it would act as a reminder about the dangers associated with sexual behaviour.

In addition to research suggesting directly that risk perceptions and intentions may change following HPV vaccination there is evidence that misconceptions are held about the vaccine which may lead girls to believe their risk of STIs or pregnancy has reduced, as was alluded to in Chapter 6. Vaccinated adolescents have been shown more likely than

unvaccinated individuals to believe that the HPV vaccine is more effective than it actually is. Around 63% of 13-18 year old American high-school girls who had received the HPV vaccine (n=59) believed that they were protected against gonorrhoea, 63% believed the vaccine protected against chlamydia and this was higher than non-vaccinated students, although all vaccinated students thought that they could still contract some STIs following vaccination (Mathur et al., 2010). Similarly an Australian qualitative study conducted after the initiation of a national immunisation programme reported that girls confused HPV with other STIs and some believed they were protected from STIs generally, some from pregnancy, and some believed they were completely protected from cervical cancer after receiving the vaccine (Robbins et al., 2010). Finally adolescents report that they do not know why vaccines are given and confuse vaccination with diagnosis (Benin et al., 2010), suggesting that some may believe that HPV vaccination is akin to a sexual health check-up. Adolescents may be highly motivated to believe that their risk of infection or pregnancy has been reduced due to the social barriers that exist that hamper communication about sex. Believing oneself at a reduced risk may be the 'excuse' needed to put-off talking to a partner about using condoms.

HPV vaccination may also affect the factors that qualitative studies have highlighted as influencing adolescent sexual behaviour. Although most of the vaccinated young Danish women in a focus group study by Mortensen (2010) reported that they would still used condoms to prevent pregnancy and other STIs, those who were in a steady relationship felt that HPV vaccination was a chance for a 'clean slate' and possibly an opportunity to cease using condoms in that particular relationship. It also appears that social expectations for sex may alter following HPV vaccination as Brabin et al.'s (2010) study also showed that 19% of the girls surveyed believed that their boyfriends might expect them to take more risks because they had received the vaccine. Finally, Marston et al.'s (2006) findings suggest that behaviour will not change because girls do not have absolute control over their sexual behaviour as they are bound by social expectations, norms and the penalties that accompany deviation from acceptable standards.

Some of the factors that are associated with sexual behaviour have not been investigated in relation to HPV vaccination, for example the effect of HPV vaccination on intentions to have sex, peer's normative beliefs about sex, time spent at home alone or pleasure gained through sexual activities, although HPV vaccination is unlikely to influence sexual pleasure or parents' decisions to leave a child at home alone. However, Chapter 6 did allude to adolescents believing that HPV vaccination decisions reflect parental norms towards sex. Research has also not reported how effective girls believe the HPV vaccine to be so it is unknown whether efficacy beliefs will likely affect risk perceptions nor has research considered whether girls are fully cognisant of their vaccination status when engaging in sexual behaviours (two of Hedlund's four criteria).

The impact of HPV vaccination on parent-daughter communication about sex

There is evidence that HPV vaccination is associated with the likelihood that parents engage their daughters in conversations about sex. Roberts, Gerrard, Reimer and Gibbons (2010) in a cross-sectional study found vaccinated college students (age 18-25) more likely to have received the vaccine if they had spoken to their mother about sex and the values of sex. However, given the correlational nature of the data it may have been that discussions between mothers and daughters about whether to receive the HPV vaccine naturally led to discussions about sex and the mothers' sexual values, or that the type of parent who discusses sex with their daughter is more likely to encourage vaccination.

The impact of HPV vaccination on cervical cancer screening attendance intentions

In addition to concern expressed by parents about changes in sexual behaviour, concern has been raised in the academic literature about reductions in cervical cancer screening attendance in girls who receive the HPV vaccine because they falsely believe that screening is unnecessary after vaccination (Crosbie & Brabin, 2010). There is evidence from a Danish focus group study of 16-26 year old women that some vaccinated individuals feel a sense of increased security after receiving the HPV vaccine and do not plan to attend for cervical cancer screening as regularly as recommended (Mortensen, 2010). These young women were not aware that the virus could remain undetected for many years and believed their first cervical cancer screening appointment would be sufficient to confirm that they

were not at risk of cervical cancer. Only around 9% of adult women in a Belgian study believed that cervical cancer screening was unnecessary if the HPV vaccination were received (Donders et al., 2008) but younger women (<25 years) more likely believed that it would no longer be required. There is no evidence suggesting that girls are motivated to not attend (or to attend) for cervical cancer screening, or that they do or do not feel they have control over whether they attend for cervical cancer screening (two of Hedlund's four criteria).

THE PRESENT STUDIES

The majority of the research presented considering behaviour change following HPV vaccination was conducted in Europe, in comparison to the wealth of literature on HPV vaccination acceptability generally that has been conducted in the United States. This suggested that behaviour change issues are more on the radar of researchers in Europe than elsewhere in the world and that it is a pertinent research topic to consider in a British sample.

However, none of the existing literature used prospective methodologies, meaning that causality could not be assigned to HPV vaccination per se, nor could pre-existing beliefs and past behaviours be controlled for in analysis. The studies also have not been able to account for the effect of the immunisation programmes themselves. These programmes have accompanied significant educational and advertising campaigns that unvaccinated girls will have been exposed to as well as those who opted to receive the vaccine. The two studies presented in this chapter sought to overcome these issues and were designed to address aim four of this thesis: to examine the effect of participation in the HPV immunisation programme on sexual behaviour in older girls participating in the 'catch-up' programme. Based on the existing literature, it was also deemed important to consider risk perceptions, cervical screening intentions and parent-daughter communication about sex.

The first study was a prospective study and explored differences in changes in risk perceptions, sexual behaviour, parental communication about sex and intentions to attend for cervical cancer screening between vaccinated girls and girls who had opted not to

receive the vaccine. The study design meant that baseline differences between the two groups could be controlled for.

Were differences in change present in this study they could have been due to exposure to the immunisation programme itself (for example the advertising campaign accompanying the programme), rather than due to receipt of the HPV vaccine and the prospective study was not able to consider this. It is important to understand whether it is the programme itself that affects adolescents rather than the receipt of HPV immunisation. The second study overcame this issue by comparing girls who had not been offered the HPV vaccine with girls who had received the HPV vaccine and was a quasi cross-sectional study. This quasi cross-sectional study could be compared to a wait-list control study in the sense that one group of girls who had received the vaccine were compared to girls who had not yet been offered the vaccine. Because the HPV 'catch-up' programme was implemented so quickly it was not possible to concurrently recruit these two groups and for this reason the study was a quasi cross-sectional study (the girls who had not been offered the vaccine were studied one whole year before those who had received the vaccine, which would not be the case with a traditional wait-list control study). The methodologies and results of these two studies have been presented separately, but the findings are discussed together.

STUDY 1 – A PROSPECTIVE STUDY

The existing literature described in this chapter and theory outlined in Chapter 3 allowed a number of hypotheses to be drawn for this prospective study.

1. Girls who believed themselves at greater risk of HPV infection, cervical cancer and other STIs prior to HPV vaccination will be more likely to have received the HPV vaccine.
2. Girls who receive the HPV vaccine will have greater reductions in their perceptions of risk for HPV infection, cervical cancer and other STIs after receiving the vaccine than girls who did not take up the offer of vaccination.
3. Girls who have received the HPV vaccine will have changed their sexual behaviour relative to those who did not take up the offer of vaccination.

4. Girls who have received the HPV vaccine will have increased the amount that they speak to their parents about sex relative to those who did not take up the offer of vaccination.
5. Girls who have received the HPV vaccine will have decreased their intentions to attend for cervical cancer screening in the future relative to those who did not take up the offer of vaccination.

Methods

Design

Study 1 was prospective in design, tracking risk perceptions, sexual behaviours, communication about sex with parents and intentions to attend for cervical cancer screening in the future in girls in school year 12 and 13 (aged 16-18 years) over a six month period. The analysis compared whether there were differences in changes in the dependent variables between girls who received the vaccine and those who did not take up the offer. Data collection occurred before (baseline) and after (follow-up) the offer of HPV vaccination (see Figure 7.1). The analysis controlled for the risk perceptions, sexual behaviours, communication about sex with parents and intentions to attend for cervical cancer screening reported at baseline. The term 'declined vaccination' was used in the figures and tables to denote not taking up the offer of HPV vaccination although it is acknowledged that non-receipt may not have been an active decision. Detailed inclusion criteria are presented in Table 7.1.

Figure 7.1 – Timeline for data collection

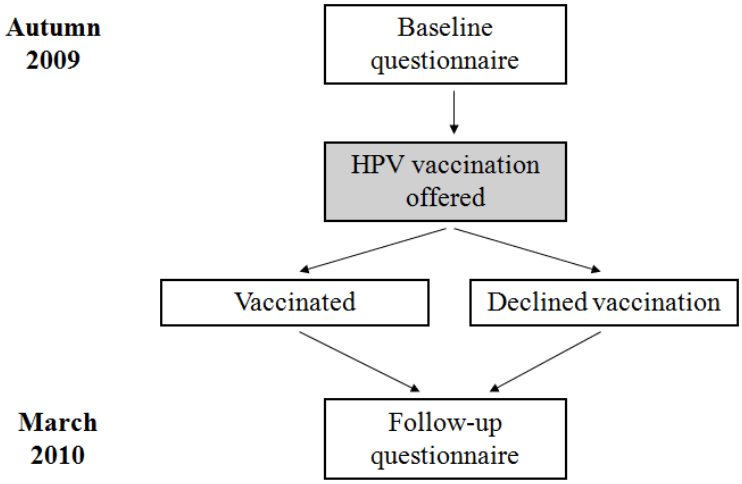


Table 7.1 – Inclusion criteria for each group

Declined vaccination	Vaccinated
Had not received the HPV vaccine at follow-up	Had received the HPV vaccine at follow-up
Had not received the HPV vaccine at baseline	Had not received the HPV vaccine at baseline
Participated at both baseline and follow-up	Participated at both baseline and follow-up
≤ 18 years old [a]	≤ 18 years old

[a] Respondents who were over the age of 18 were excluded as they were not entitled to receive the HPV vaccine as part of the national immunisation programme (n=25 of all participants).

Participants

Adolescent girls in school year 12 and 13 (usually aged 16-18 years) were recruited in September-November 2009 from eight further education and sixth form colleges in London and the South East of England. This cohort of girls was tracked for six months and asked to participate twice in total (completing a baseline and follow-up questionnaire).

It was calculated that a sample of 788 participants was required to examine between-group differences in behaviour. Based on risk perception theory and logical arguments set out in the introduction to this chapter (supposing that it was not expected that sexual behaviour would change or that effects would be small) the following assumptions were made when determining sample size: alpha=.05, power=.8, number of groups=2, effect size (r) =.1[17]. Experience of other researchers adopting similar methods found attrition of up to 50% (10% of students did not complete the academic year or were absent on the day of data collection and 40% were not compliant in providing accurate information allowing them to be tracked prospectively). It was also anticipated that not every college would complete the study due to unforeseeable events. As a result ~1700 participants were needed to be recruited at baseline.

The colleges were chosen based on ease of travel; it was anticipated that data collection would commence before 9am in some colleges and so each college needed to be within 1.5 hours of London to avoid overnight stays for researchers. Colleges that met this criterion were recruited opportunistically until the sample size was fulfilled. Initially the head of sixth form/FE college was contacted by telephone to give them brief information about the project and this was followed up with an information pack sent via email. The information pack included an explanation of the study, a copy of the questionnaire, information sheet and consent form (see Appendix 16 and 17). Contact was made with 10 colleges and eight agreed to participate, two of which had previously completed research with the Health Behaviour Research Centre, but none of whose data were included in this thesis (see Table 7.2 for details of the included colleges). These were a combination of small and medium sized sixth form colleges and two large further education colleges. It was decided to recruit from colleges as just over 63% of 16-18 year olds remain in further education and so the majority of girls who were eligible for vaccination were accessible (Office for National Statistics, 2008). Education establishments also provide an existing structure for data to be collected in a systematic format (students sitting at desks) and data collection could be observed and controlled by the researcher. It was requested that the colleges make all

[17] This sample size was used with caution as complex samples models were planned to be run which would reduce power. Post-hoc power calculations were reported in the results section to ensure transparency of actual power achieved, even if the desired sample size was met.

female students available to participate in the research. All colleges except College 7 provided access to all female students in the college. College 7 provided access to female students participating in vocational 'Health and Social Care' courses. This resulted in a lower response rate for this college but did allow students with a lower educational attainment to be included in the sample. Such students were not accessible in all of the other colleges as some of the smaller colleges offered a narrower range of subjects for students to study.

Table 7.2 – College demographic characteristics

	College								
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**Total**
Location	Surrey	Brent London	Brent London	Surrey	Camden London	Westminster London	Tower Hamlets London	Hackney London	-
Type	FE college	Sixth form	Sixth form	FE college	Sixth form	Sixth form	Sixth form	Sixth form	-
Single sex	No	No	No	No	No	No	Yes	Yes	-
Location that vaccine was offered	GP	School	School	GP	School	GP/pharmacy	School	School	
Response rate Denominator= number attending session									
Baseline N (%)	589 (90.0)	31 (100)	63 (100)	19 (100)	100 (98.0)	189 (96.4)	31 (100)	97 (98.5)	1119 (97.9)
Follow-up N (%)	542 (98.0)	No participants	16 (100)	Not recruited	39 (100)	142 (91.0)	29 (100)	68 (98.6)	836 (97.9)[a]
Total N (%)	1131 (94.0)	31 (100)	79 (100)	19 (100)	139 (99.0)	331 (93.7)	60 (100)	165 (98.6)	1955 (98.2)[b]
Response rate Denominator= number registered in college									
Baseline N (%)	589 (75.0)	31 (45.6)	63 (73.3)	19 (3.3)	100 (56.5)	189 (86.7)	31 (8.7)	97 (85.7)	1119 (54.4)
Follow-up N (%)	542 (76.3)	No participants	16 (12.3)	Not recruited	39 (22.0)	142 (65.1)	29 (8.1)	68 (88.3)	836 (45.4)[a]
Total N (%)	1131 (75.7)	31 (45.6)	79 (42.8)	19 (3.3)	139 (39.3)	331 (75.9)	60 (8.4)	165 (87.0)	1955 (42.3)[b]

[a] Total excludes the follow-up response rates for College 2 and College 4.
[b] Total includes the response rates for College 2 and College 4.

Procedure

Choice of data collection method

Questionnaires were chosen as the most suitable format for data collection. It was considered most appropriate that the questionnaires be completed during college hours so that they could be collected immediately by researchers and also reduced the possibility that questionnaires would be misplaced by participants leaving their sensitive responses vulnerable to be seen. It was believed that questionnaire responses provided anonymously to the researcher would be more honest than if this information was determined in face-to-face interviews.

Pilot work

The questionnaire was piloted using cognitive interviewing with three girls in the appropriate age group. The questionnaire was also completed by other individuals to gauge how long it would take to complete.

Baseline assessment

In September-November 2009 all year 12 and 13 female students attending tutorial sessions were invited to take part[18]. The study was completed in classrooms in Colleges 1, 4 and 7 and in an assembly hall in Colleges 2, 3, 5, 6 and 8. All respondents completed the questionnaire during a tutorial period. Given the sensitive nature of the information asked in the questionnaires special considerations were made to reassure participants that their responses would be anonymous and confidential. It was hoped that these measures would maximise the honesty of the answers provided and reduce the amount of missing data. Methods used by Testa and Coleman (2006) were followed and adapted. Presumed consent was adopted based on the participants' completion of the questionnaire so participants did not have to ever disclose their name. The questionnaires were printed A5 size so that responses could easily be concealed from other students. Dependant on space constraints, participants were asked to ensure that they did not have anyone sitting next to them when

[18] In College 1, year 12 boys (n=216) completed a similar questionnaire at the same time as the girls. The college requested that the boys participated in the research. The boys' results were not discussed in this thesis.

they answered the questionnaires to maximise the privacy of their responses. Finally a word-search was provided at the end of the questionnaire to keep respondents occupied when they had completed the questionnaire while others were still finishing. This helped to ensure that finished participants did not disturb others and made respondents who were still completing the questionnaire feel reassured that no one was looking at their answers. Fieldworkers from the Health Behaviour Research Centre at UCL helped administer the questionnaires and in every college the session was run by an individual independent to the college; completed questionnaires were collected by the researcher only and were never touched by the participants' teachers. This method has been shown to result in more accurate responses than asking the students' teachers to administer the sessions (Testa & Coleman, 2006). Fieldworkers received training prior to administrating the questionnaires and documented the number of students attending the session and the number of students refusing to participate. The study received a favourable ethical opinion from the UCL research ethics committee (Appendix 18).

Follow-up

In March 2010 these girls were approached again using the same procedures and asked to participate in a follow-up questionnaire (Appendix 17).

Vaccination receipt

Between baseline and follow-up the girls were offered the HPV vaccine as part of the 'catch-up' immunisation programme. This study had no influence on whether girls were offered the vaccine or whether they chose to receive the vaccine or not. Some primary care trusts offered the vaccine to girls in their colleges whereas others offered the vaccine through the girls' GPs or pharmacies (Table 7.2).

Measures

The dependent variables of perceived risk, sexual behaviours, communication about sex with parents and intentions to attend for cervical cancer screening in the future were assessed along with the main independent variable, vaccination receipt and factors that were established to be associated with the dependent variables (see Table 7.3). Other

variables were assessed in the questionnaire but were not considered for the analyses in this chapter.

Table 7.3: Factors established to be associated with each dependent variable that were adjusted for in the second model run for each dependent variable

	Factors established to be associated with the dependent variable	Reference
Sexual debut	Having ever had a boyfriend	Kaestle et al. (2002) Marin et al. (2006)
	Drug use	Donnelly et al. (2001)
	Subjective norm for my parents think I should have sex this year	Buhi et al. (2007)
	Subjective norm for my friends think I should have sex this year	Buhi et al. (2007)
Age of sexual debut	Subjective norm for my friends think I should have sex this year	Buhi et al. (2007)
	Being a smoker	Donnelly et al. (2001) Tucker, et al. (2006)
	Having ever had a boyfriend	Kaestle et al. (2002) Marin et al. (2006)
Condom use	Oral contraceptive use	Woods et al. (2006)
	Subjective norm for my parents think I should use a condom when I next have sexual intercourse	Buhi et al. (2007)
	Subjective norm for my friends think I should use a condom when I next have sexual intercourse	Buhi et al. (2007)

Dependent variables

Risk perceptions

Risk perceptions were assessed because the theory described in Chapter 3 and in the introduction to this chapter suggested that changes in sexual behaviour and intentions to attend for cervical cancer screening in the future following HPV vaccination would be the result of altered risk perceptions. To measure perceived susceptibility to HPV, cervical cancer and STIs two dimensions of the construct were measured: perceived likelihood and feelings of risk. Both of these dimensions were measured using single items to reduce the length of the questionnaire and avoid repetitive questions. Single item measures of perceived risk are acceptable if well chosen (Weinstein et al., 2007). In accordance with recommendations for measuring perceived risk (Brewer et al., 2004) the items specified the person, threat, time period and considerations of future behaviour.

Likelihood of illness/infection

There is no agreed gold standard for measuring perceived likelihood (Weinstein et al., 2007) and previous assessments in the context of cervical cancer have employed both absolute measures (e.g. Gerend & Magloire, 2008; Ingledue et al., 2004; Kahn et al., 2001; Marteau et al., 2002) and comparative measures (e.g. Marteau et al., 2002; Price et al., 1996). Absolute and comparative measures of susceptibility can result in different perceptions of risk. Lipkus et al. (2000) found that women overestimated their risk of breast cancer when asked using an absolute measure and underestimated their risk when asked using a comparative measure. As it was hypothesised that perceived likelihood of cervical cancer, HPV and STIs would reduce in young women once they had received the HPV vaccine an absolute measure was chosen. Using a comparative measure of perceived likelihood may have resulted in floor effects at baseline measurement and have not allowed for possible reductions in risk perception to be visible.

Numerical risk probabilities can be difficult for lay populations to understand (Black et al., 1995; Lipkus et al., 2001; Schwartz et al., 1997; Yamagishi, 1997) and verbal scales have been found more reliable, valid and easier to use (particularly 7-point scales; Diefenbach et al., 1993; Woloshin et al., 2000).

Consequently, an absolute-risk measure of perceived likelihood of being diagnosed with cervical cancer and being infected with HPV or STIs was chosen using the 7-point verbal linear scale as used by Diefenbach et al. (1993). For example, 'If I never have the HPV vaccine, my chance of getting infected with an STI in the future is…', response: no chance, very unlikely, unlikely, moderate chance, likely, very likely, certain to happen'. The prefix 'If I never have the HPV vaccine' was removed for assessment at follow-up when the participants could have received the HPV vaccine and information about HPV was provided prior to the questions about HPV (see Box 7.1).

Feeling at risk

A dimension of perceived risk that has been gaining interest is 'feelings of risk'. The concept has been found to produce stronger correlations with actual behaviour than reported perceived likelihood (Weinstein et al., 2007). Although its superiority is becoming established, because of its novelty it is unknown whether measurement is likely to result in participants giving unrealistically optimistic (Weinstein, 1980) responses in the context of cervical cancer, HPV or STIs and creating an undesirable floor effect. Consequently it was deemed appropriate to measure both dimensions of perceived risk. Feelings of risk were assessed with an item used by Weinstein et al. (2007), 'If I never have the HPV vaccine, I would feel very vulnerable to HPV in the future', response: strongly disagree, disagree, not sure, agree, strongly agree. The prefix 'If I never have the HPV vaccine' was removed for assessment at follow-up.

Box 7.1 – Information provided to participants before sexual behaviour, HPV and cervical cancer screening questions

Sexual behaviour information
The next questions are about people you have had sexual intercourse with. Please include every person you have ever had sexual intercourse with whether it was just once or a few times or a regular partner. By sexual intercourse we mean vaginal sex.

HPV information

Human papillomavirus (HPV) is a very common infection involved in most cervical cancers. It is transmitted via skin-to-skin contact, most commonly during sexual activity. A vaccine has been developed that protects against this infection. This school year/next school year you are being/will be offered the HPV vaccine [a].

Cervical cancer screening information

Women aged 25-64 years are offered cervical screening (also known as a smear test) every 3-5 years.

Cervical screening checks the health of the cervix (neck of the womb), and allows doctors to find changes in the cervix before they can develop into cancer.

During the cervical screening test the doctor or nurse will ask you to lie down on a couch. They will then gently put a small instrument, called a speculum, into your vagina to hold it open. Then they will wipe a small spatula or a brush-like device over the cervix to pick up some cells. They will transfer these cells into a small container of liquid, and send it away for the cells to be examined under a microscope. The test takes just a few minutes.

a Varied by time point

Sexual behaviour

Questions assessing age of sexual debut, number of sexual partners with definitions provided to participants (see Box 7.1) were adapted from the National Surveys of Sexual Attitudes and Lifestyles (NATSAL) 2000 ('how many people have you ever had sexual intercourse with?' and 'how old were you when you first had sexual intercourse?'; 'I have never had sex' was provided as an option). The survey was originally completed by 11,161 16-44 year old males and females, and has been used to measure changes in sexual behaviour over time (Fenton et al., 2001b; Johnson et al., 2001; Wellings et al., 2001). It underwent considerable acceptability and reliability testing during its development (Wellings et al., 1990). The variable 'having ever had sex' was determined using participants' responses to these questions (coded: 'had sex', 'never had sex').

Questions assessing previous barrier contraceptive use were from the RIPPLE study (Stephenson et al., 2004; 'when you have sexual intercourse how often do you use a condom?' Response: Never, hardly at all, less than half the time, about half of the time, most times, every time or I have never had sex'). The study questions from RIPPLE were originally used with 13-16 year olds to evaluate the effectiveness of a peer-led sex education intervention.

It was not feasible in the current study to validate sexual behaviour self-reports, however other researchers have made attempts to do so. Bhave et al. (1995) examined STI incidence (HIV, hepatitis B and syphilis) as well as self-reported sexual behaviour. Similarly, Hobfoll et al. (1994), in addition to asking for self-reported behaviour, gave study participants a credit card to obtain free condoms from a pharmacy. The pharmacy then provided details of the number of women who used this service. In both of these studies analyses that were significant for self-reported behaviour were also significant for objective measures of behaviour and in the same direction, for example self reported use of condoms for vaginal sex increased as did the number of condoms obtained from the pharmacy. This suggests that self-report measures of sexual behaviour are as reliable as objective measures.

Parental communication about sex

Previous communication about sex with parents was assessed by asking whether respondents had ever spoken to their parents about six sex-related topics. Five of the topics formed a highly reliable scale developed by Hutchinson, Jemmott, Jemmott, Braverman, and Fong (2003); HPV vaccination was added to this scale for the present study and gave acceptable Cronbach's alpha levels. The Cronbach's α for baseline=.70 and for follow-up=.75.

Intention to attend for cervical cancer screening in the future

Intentions to attend cervical cancer screening when older were measured using the average of two items that followed the structure used by Sheeran and Abraham (2003): 'when I am older and am invited to go for a smear test, I intend to go' and 'when I am older and am invited to go for a smear test, I will try to go'; response: strongly disagree, disagree, not sure, agree, strongly agree. The two items measuring intention to attend cervical cancer screening were highly reliable. The Cronbach's α for baseline=.86 and for follow-up=.86. Information about cervical cancer screening was provided to participants before they answered these questions (see Box 7.1).

Independent variable

Vaccination receipt

Girls were asked to indicate their vaccination status using the following options 'I have received all three doses of the HPV vaccine' or 'I have received 1 or 2 doses of the HPV vaccine and will complete the course of injections' or 'I have received 1 or 2 doses of the HPV vaccine and will not complete the course of injections' or 'I have been offered the HPV vaccine but I haven't yet had it' or 'I have been offered the HPV vaccine but have decided not to have it' or 'I have not been offered the HPV vaccine'. Those who had received any dose of the HPV vaccine were classified as having had the HPV vaccine and those who had not received at least one dose of the HPV vaccine were classified as having not had the HPV vaccine. These items were developed for the present study.

Potential confounding variables known to be associated with sexual behaviour

Subjective norms

A subjective norm is the extent that an individual believes that others think they should perform a certain behaviour coupled with how motivated the individual is to behave as others think they should. Subjective norms have consistently been shown associated with condom use, having ever had sex and age of sexual debut (Buhi & Goodson, 2007). Normative beliefs for sexual behaviour (beliefs about parents' and friends' beliefs about whether the participant should have sex this year and should use a condom next time the participant has sexual intercourse) were assessed along with two items tapping general motivation to comply with the individuals described (parents and friends). The format of these questions followed the structure described by Armitage and Conner (1999), for example, 'my parents think I should use a condom when I next have sexual intercourse' and 'in general, I want to do what my friends think I should do', response for both types of question: strongly disagree, disagree, not sure, agree, strongly agree. Subjective norm scores were calculated following the procedure recommended by Trafimow (2008; normative belief x motivation to comply).

Smoking

Current smoking status was assessed as it is associated with an earlier sexual debut (e.g. Donnelly et al., 2001; Tucker et al., 2006). Girls responded to a question adapted from Clemens, Jotangia, Lynch, Nicholson and Pigott (2008); 'do you smoke?' with either 'yes' or 'no' as a response option.

Oral contraceptive use

Oral contraceptive use was assessed as it appears that participants who adopt alternative methods of contraception to condoms are less likely to be consistently using condoms at sexual intercourse (Woods et al., 2006). In this study the authors reported that 26% of 14-17 year old girls were solely using oral contraceptives at coitus. Girls may be especially less likely to use barrier contraceptives in addition to an oral contraceptive if both partners were virgins prior to engaging in sexual activities together and so considered their risk of STIs to be minimal. In 2008/2009 in Great Britain oral contraceptives were the second

most common contraceptive method used by 16-19 year old girls after male condoms (Office for National Statistics, 2009); in respondents who were using at least one form of contraception, 65% were using the male condom and 54% were using the contraceptive pill. Other methods of contraception were rarely used by 16-19 year olds, for example the next most common contraceptive method used was emergency contraception (7%). The girls responded to the question 'do you take the pill (oral contraceptives)?', response: yes, no. This question was developed for the present study as I was unable to locate another study that had asked solely about oral contraceptive use. Previous studies had included other methods of contraception.

Illicit drug consumption

Illicit drug consumption was assessed as it is associated with having had sexual intercourse (Donnelly et al., 2001). It was assessed using a question from a government commissioned national survey of smoking, drinking and drug use among young people (11-15 year olds) in England (Clemens et al., 2008). 'How often do you usually take drugs that you did not get from your doctor or chemist (illegal drugs)?', response: never, only a few times a year, about once a month, about once a fortnight, about once a week, about twice a week, every day or almost every day.

Relationship status

Having a partner is a predictor of sexual activity in adolescence and the effect appears present at a range of ages suggesting that age of sexual debut is also affected by relationship status (Kaestle et al., 2002; Marin et al., 2006). Relationship status was assessed using a measure developed for the present study by asking respondents: 'Have you had a boyfriend or girlfriend at all since starting secondary school?', response: yes, no. The measure was comparable to those used by Marin et al. (2006) and Carlson et al. (1990).

Demographic questions

Ethnicity

Ethnicity was assessed using classifications from the UK 2001 census (Office for National Statistics, 2001).

Religion

Religion was assessed using classifications from the UK 2001 census (Office for National Statistics, 2001). Respondents who identified themselves as having a religion were asked to indicate if they were practising that religion; 'Would you say that you are practising this religion?', response: yes, practising or no, not practising. An option was provided for 'I do not have a religion'.

Socioeconomic status

Receipt of educational maintenance allowance (EMA) and amount received was used as a crude measure of socioeconomic status. EMA is a term time payment given to 16-18 year old students who remain in education after the end of compulsorily studies. The amount received is calculated using household income (income of <£20,817 per year earns £30 per week, £20,818-£25,521 per year earns £20 per week, £25,522-£30,810 per year earns £10 per week, students with a household income >£30,810 per year have no entitlement to EMA). The girls were asked 'how much EMA (educational maintenance allowance) are you normally entitled to receive per week?'; response: £30, £20, £10 or 'I am not entitled to EMA'.

Matching data between time points

To anonymously match the participants' responses between baseline and follow-up, the girls were asked to provide their postcode and date of birth. The participants were not immediately identifiable in person by the researchers knowing this information but it was likely to remain stable between time points. The colleges were never permitted to see the questionnaires and so were not able to match this participant information to their students. It was not possible to contact any participant who was absent at follow-up and so their data

was missing. Occasionally at follow-up participants provided incomplete matching data, where possible or appropriate, attempts were made to match their questionnaire with participants from baseline using other information that was deemed to be stable (for example, ethnicity). Participants were matched in this way on 25 occasions. Three participants could not be matched as they had the same date of birth, postcode and ethnicity so they were entered as new participants.

Analysis

Response rate

Two response rates were calculated. In the first response rate the denominator was the number of female students registered in the colleges. Anecdotally, colleges reported that around 10% of students registered at the beginning of the school year do not complete their courses and the colleges were unable to provide up-to-date records of the number of students attending the college at the time of data collection. This first response rate was likely to be an overly conservative estimate of participation. The denominator of the second response rate was the number of students attending the tutorial session when data collection took place. It was anticipated that the true response rate would be between these two estimates.

Missing data

At baseline 14 cases had >50% data missing so were excluded from the analysis and 11 cases were excluded for this reason in March 2010. On rare occasions, participants reported what was considered to be an implausible response (very high number of sexual partners, low age of sexual debut); these responses were considered outliers and were coded as missing. Similarly, on a small number of occasions respondents provided a response at follow-up that was incongruent with their response at baseline (for example they reported having fewer lifetime sexual partners at follow-up than they did at baseline). These responses were labelled as missing for follow-up (number of sexual partners n=7; communication about sex n =135; had sex n=38, age of sexual debut n=11, vaccine receipt n=3). The high number of incongruent responses for parental communication about sex raises questions about the reliability of this measure.

Missing values were retained in the dataset for analysis and were not imputed. It was deemed inappropriate to impute the main variables under consideration for this study (whether the girl had received the HPV vaccine and her sexual behaviour). The analysis for the present study was intended to explore the variation in the dependent variables that was not explained by factors that are already known to predict it. Expectation maximisation methods would have used the factors that are already known to predict the dependent variable to impute the dependent variable (for example imputing number of sexual partners using parental normative beliefs). This would have been undesirable because it would generate values for the dependent variables that were explained by the factors that would have been adjusted for in analysis. Replacing missing values with mean scores would have reduced the variance in the data resulting in reduced effect sizes. Given that effect sizes were hypothesised to be small or even non-significant, mean imputations were also considered unsuitable. There were a small number of missing values for the variables (average 3.25%, see Appendix 19) so non-imputed data were used. Although generally missing data were rare, two of the questions about sexual behaviour were unanswered by a larger proportion of participants (number of sexual partners – follow-up measure: 12.0% missing, age of sexual debut – follow-up measure: 9.6% missing). These questions were likely to have been considered too sensitive to disclose in a questionnaire and this was unsurprising. However, it was unfortunate that a higher percentage of participants did not answer these questions. Procedures described in the methods section were adopted to reassure participants of confidentiality and participants have previously reported a preference for self-completion questionnaires over face-to-face interviews when disclosing sensitive information (Tourangeau & Smith, 1996).

When summing the number of topics about sex discussed with parents the final score was coded as missing if any value was missing from the items contributing to the summed score. Too few participants identified themselves as belonging to some ethnic and religious groups making group sizes too small for statistical comparisons to be made. These groups were grouped together and labeled as ‘other’. The creation of an ‘other ethnicity’ and an ‘other religion’ group meant that inferences could not made about that group specifically, only comparisons made with it.

Statistical analysis

Statistical analysis was performed using SPSS version 14 (SPSS Inc., 2005). A number of the dependent variables showed statistically significant skewness and kurtosis. As the values for these variables were meaningful it was decided not to transform this data (for example the actual number of sexual partners would be more informative than a transformed score) and to dichotomise non-normally distributed dependent variables. A median split was used for number of sexual partners (dichotomised into number of sexual partners at or below the median versus number of sexual partners above the median; median=0 for both analysis), number of topics about sex discussed with parents (dichotomised into number at or above the median – 'high communication about sex' versus number below the median – 'low communication about sex'; median=4, range:0-5) and intention to attend for cervical cancer screening in the future (dichotomised into intention below the median – 'low intention' versus intention at or above the median – 'high intention'; median=3, range:0-4). Condom use was dichotomised into 'always uses condoms' versus all other responses as this was considered most meaningful (inconsistent condom use of any kind increases risk of pregnancy/STI infection).

The first analysis run was designed to help choose the best measure of perceived risk to be used in the rest of the analysis. Complex samples univariate logistic regression models were performed as the sampling design meant that the data were clustered. An inherent assumption of statistical analysis is that samples are random. This was not the case for the present study as participants were recruited from colleges and not randomly sampled from the population. As a result the participants were clustered by college. Complex samples analysis overcomes violated assumptions of independence by taking the cluster into account (in this case the cluster was 'college') and usually produces a more conservative alpha statistic than simple analysis. SPSS was a suitable programme for performing complex samples analysis however it did not provide some of the desired output statistics that are produced by non-cluster adjusted analytical techniques; in these cases non-clustered statistics were reported so long as they were not dependent on the alpha or its confidence intervals (for example effect sizes). For the logistic regression Nagelkerke's pseudo R^2 was reported and odds ratios (OR) with 95% confidence intervals (CI). I examined standardised residuals from non-clustered models (again because SPSS did not

provide these statistics) to look at how well the model fit the data. Cook's distance and DFBetas from non-clustered models were examined to check for outliers. I also ran complex samples univariate logistic regression to examine whether perceived risk at baseline predicted vaccination status at follow-up.

I next intended to look at whether any changes in the dependent variables between baseline and follow up were different between those who were vaccinated and those who opted not to receive the vaccine. The dependent variables I considered were risk perceptions, sexual debut, age of sexual debut, number of sexual partners, condom use, intention to attend for cervical cancer screening and communication about sex with parents. When the dependent variable was continuous I ran complex samples analysis of co-variance (ANCOVAs) run as general linear models (GLM) using Wald's F. I determined the appropriateness of each model by examining interaction effects although I decided a priori to not to consider interactions for the analysis. I used Partial H^2 as an effect size, and power that were derived from non-clustered models as SPSS did not provide effect sizes or power estimations for complex samples analysis. When the dependent variable was dichotomous I ran complex samples logistic regressions using the statistics reported above for the perceived risk analysis.

For both types of test I ran two models. The first included vaccination status and the baseline version of the dependent variable. The second model also adjusted for factors that are established in the literature to be associated with the dependent variable and included just demographic characteristics for the cervical cancer screening intentions and the communication about sex analysis (see Table 7.3). I would have liked to have included demographic characteristics in all of the second models, but their inclusion in the models cause instability due to small numbers in certain groups. As a consequence, demographic characteristics were only considered for the two dependent variables that have not shown consistent associations with other factors. Unadjusted change scores have been presented for descriptive purposes but they were not used for analysis. The methods that were used for analysis have been considered better as they are unaffected by baseline imbalances between groups, unlike change score analysis (Vickers & Altman, 2001).

It was not possible to run analysis comparing differences in changes in sexual debut, change in age of sexual debut or change in number of sexual partners for the whole sample. For the sexual debut analysis, participants were unable to have reached sexual debut at baseline but to have not reached sexual debut at follow-up causing some cells in the analysis to be empty and making it impossible for these models to be run. For the age of sexual debut analysis it was not possible for a participant to have changed their age of sexual debut and so this analysis was not appropriate. For the analysis looking at number of sexual partners, splitting the sample at the median (0) meant that this analysis would again attempt to look at changes in having ever had sex and so could not be performed. Instead, this analysis was performed with only girls who had ever had sex at baseline.

My role in this study

I conceived and designed this study with advice from Professor Wardle and Dr Waller. I developed or decided upon the measures for the study myself. I gained ethical approval for the study, including writing a detailed protocol, designed the information materials, consent form and questionnaire. I recruited the colleges, managed the study generally and prepared for data collection on my own. Colleagues from the Cancer Research UK Health Behaviour Research Centre helped with data collection and I provided them with a briefing them about procedures and organised when and where they were needed in the colleges. I was present at each data collection time point and site. I entered the data and received help from three data entry workers for entering the data from the follow-up questionnaire. I made random checks to ensure accuracy. I conducted data analysis with supervision from Mr Boniface and Dr Waller.

Results

Response rate

At baseline, College 4 was unable to accommodate the research in the manner described in the procedure section. Due to timetabling difficulties the coordinator in the college asked students to come to a quiet room to complete the questionnaire when they were not in lessons. This resulted in very few girls choosing to come to the session (19 students completed the questionnaire over three eight-hour day sessions) and also meant that these

girls would complete the research under different conditions from the rest of the sample. It was decided not to recruit from College 4 at follow-up. At follow-up in College 2 attendance at tutorial session was not mandatory for the students as they were in a revision period, the coordinator in the college failed to tell the girls to come to the session and so no participants turned up. The coordinator was unable to reschedule the data collection session for a later date because of exams. As a result there was no data for College 2 at follow-up. No participants from these two colleges were used in the main analysis.

At baseline 1119 completed the questionnaire and this was 836 at follow-up (Table 7.2). Data from 407 girls were included in the analysis (n=259 who declined vaccination and n=148 vaccinated)[19]. Of the girls who were registered in the colleges, 54.4% completed the questionnaire at baseline and 45.4% participated at follow-up, giving an overall response rate of 42.3%, excluding the response rates for College 2 and College 4. Of the girls who were present in the data collection sessions 97.9% participated at baseline and 97.9% participated at follow-up. Overall, excluding the response rates for College 2 and College 4, 98.2% of girls present in the sessions completed the questionnaire. As described in the methods section the denominators for the number of girls registered in the colleges was unlikely to be accurate, as a consequence it was concluded that the overall response rate for the study was between 42.3% and 98.2%.

Description of the colleges

Statistical comparisons between colleges were not possible due to small group sizes and the variation between colleges being too great to combine colleges; however, a descriptive analysis of the colleges is provided below. For the baseline assessment the number of participants recruited from each college ranged from 19 to 589 and at follow-up it was from 16 to 542 (Table 7.2). At each time point the majority of participants came from College 1 (Table 7.4). The majority of participants from Colleges 3, 7 and 8 were from ethnic minority groups (Table 7.4). The majority of participants from Colleges 5, 7 and 8 were receiving EMA (Table 7.3). Two of the colleges only admitted girls and the rest were co-

[19] The reduced sample size was the result of the inclusion criteria prescribing that participants must have responded at baseline and follow-up for the 1st analysis, and to have detailed their vaccination status.

educational (Table 7.2). Two of the colleges were further education establishments (not linked to a school) and the other six were sixth form colleges. The majority of the girls were offered the vaccine in school but girls from three colleges had to visit their GP or local pharmacist in order to receive the vaccine (Table 7.2). Uptake of the vaccine ranged from 15.8% to 100% (mean for all colleges=52%, Table 7.4). Only in College 8 did the proportion of girls who had received the HPV vaccine match the proportion of eligible girls receiving at least one dose of the HPV vaccine in their primary care trust (PCT, Table 7.4). Out of the remaining five colleges, two colleges had a greater proportion of girls vaccinated than their PCT average and three colleges had a lower proportion of girls vaccinated than their PCT average. Generally, across the colleges a smaller proportion of the girls were vaccinated compared with the average for England. However, the PCT data were for the previous academic year.

Table 7.4: College demographics and regional statistics.

	College N (%)						Average for England
	1	**3**	**5**	**6**	**7**	**8**	
Total	223 (54.8)	6 (1.5)	21 (5.2)	101 (24.8)	12 (2.9)	44 (10.8)	
Declined vaccination	134 (60.1)	0 (0)	9 (42.9)	85 (84.2)	5 (41.7)	26 (59.1)	
Vaccinated	89 (39.9)	6 (100)	12 (57.1)	16 (15.8)	7 (58.3)	18 (40.9)	
Percent of girls receiving ≥ 1 HPV vaccine dose in the PCT that the college resided in [a]	49.1	77.1	23.2	65.2	71.5	40.4	62.2
Demographic characteristics of each college							
From an ethnic minority	43 (19.3)	5 (83.3)	10 (47.6)	41 (40.6)	12 (100)	34 (77.3)	9.1% (London: 28.4%)
Receiving EMA	64 (28.7)	2 (33.3)	19 (90.5)	41 (40.6)	12 (100)	37 (84.1)	

Note: Number of cases included for the 'from an ethnic minority' and 'receiving EMA' rows are lower than the total rows due to participants not reporting their ethnicity or EMA entitlement.
[a] http://www.dh.gov.uk/prod_consum_dh/groups/dh_digitalassets/@dh/@en/@ps/documents/digitalasset/dh_111676.pdf (Department of Health, 2010). Percentages were for girls born between 01/09/1995-31/08/1999 whereas the study participants were from the following year of the 'catch-up' programme.

Description of the sample

Most of the girls were white (62.8%), were not entitled to EMA (56.9%) and were on average 17.5 years old. Around 40% of the sample was Muslim and of those who reported a having a religion 51% were practising that religion (Table 7.5).

Table 7.5: Demographic characteristics

N=407	**n (%)**
Ethnicity	
White	250 (62.8)
Black	33 (8.3)
Asian	75 (18.8)
Other	40 (10.1)
EMA receipt	
£30	146 (36.0)
£20	15 (3.7)
£10	14 (3.4)
No entitlement	231 (56.9)
Religion	
None	142 (35.6)
Christian	70 (17.5)
Muslim	160 (40.1)
Other	27 (6.8)
Practising a religion [a]	
Yes	126 (51.0)
No	121 (49.0)
Age (mean (se)	17.51 (.02)

Note: Total columns not equalling the total for sample are due to missing data, percentages not equalling 100% are due to missing data.
[a] Of those who reported a having a religion

Best method for measuring risk

The first analysis investigated which method of measuring risk was most appropriate to use as measures of both 'perceived likelihood' and 'feelings of risk' had been taken. Data from any participant who responded in March 2010 were used to establish whether 'feelings of risk' or 'perceived likelihood' had the highest association with having the vaccination. As can be seen from Table 7.6 only the 'feelings of risk' item for HPV infection was associated with vaccination receipt, with those who had been vaccinated against HPV having lower perceptions of personal risk of HPV infection as would be predicted. 'Feelings of risk' for cervical cancer approached significance. Given that 'feelings of risk' was most highly associated with vaccination receipt, this measure of risk perceptions was used for all other analysis.

Table 7.6: Univariate logistic regression exploring predictors of vaccination receipt in March 2010

	Mean (se)	Vaccinated mean (se)	Unvaccinated mean (se)	B	SE B	OR (95% CI)[a]	p
Perceived likelihood of HPV [b] (n=763)	2.36 (.04)	2.30 (05)	2.42 (.05)	-0.12	0.07	0.89 (.77-1.03)	.12
Feelings of risk for HPV [c] (n=763)	1.51 (.03)	1.44 (.03)	1.58 (.04)	-0.26	0.10	0.77 (.64-.94)	<.01
Perceived likelihood of cervical cancer (n=760)	2.47 (.03)	2.45 (.03)	2.49 (.05)	-0.06	0.08	0.95 (.80-1.11)	.50
Feelings of risk for cervical cancer (n=762)	1.60 (.03)	1.56 (.04)	1.65 (.04)	-0.17	0.10	0.85 (.07-1.02)	.09

[a] Odds ratio for vaccinated versus unvaccinated
[b] Perceived likelihood range 0-6
[c] Feelings of risk range (0-4)

Does perceived risk predict vaccination status?

It was next considered whether perceived risk prior to vaccination could predict vaccination status. Feelings of risk for HPV, cervical cancer and STIs at baseline were moderate: HPV mean=2.22, se=.10; cervical cancer mean=2.24, se=.09; STIs mean=2.03, se=.07 (possible range 0-4). As can be seen from Table 7.7 feelings of risk for HPV infection and cervical cancer at baseline predicted whether girls received the vaccine at follow-up. Girls with higher feelings of risk were more likely to receive the vaccine. Model 1 and Model 2 could explain 3% and 4 % of the variance in vaccination receipt. Feelings of risk for STIs at baseline did not predicted vaccination receipt at follow-up. It was not possible to generate residuals for the complex samples logistic regression; in the absence of these cluster-adjusted residuals a non-clustered logistic regression was run. Fewer than 5% of the standardised residuals for all of the non-clustered logistic regressions were greater than 2 and no more than 1% were above 2.5 suggesting that the models fit the data well. No Cook's distance or DFBeta was greater than 1 indicating that no case was influencing the models over and above any other case.

Table 7.7: Can feelings of risk at baseline predict vaccination status at follow-up?

	Declined vaccination	**Vaccinated**	**R^2**
	mean (se)	mean (se)	
Model 1: Feelings of risk of HPV at baseline (n=405)	2.12 (.08)	2.41 (.12)	.03*
Model 2: Feelings of risk of cervical cancer at baseline (n=404)	2.12 (.08)	2.45 (.09)	.04**
Model 3: Feelings of risk of STIs at baseline (n=398)	1.97 (.09)	2.12 (.05)	.01

p≤ .01, **p≤ .05

Did perceived risk of HPV, cervical cancer and STIs change following the receipt of HPV vaccination to a greater extent than girls who did not take up the offer of vaccination?

First, it was considered whether vaccinated girls had changed their feelings of risk of HPV, cervical cancer and STIs following HPV vaccination compared with girls who had not taken up the offer of vaccination. At follow-up feelings of risk for HPV, cervical cancer and STIs were low generally for the whole sample: HPV mean=1.57, se=.08; cervical cancer mean=1.66, se=.08; STIs mean=1.53, se=.09. As can be seen from Table 7.8 there was no greater change in feelings of risk of HPV infection in vaccinated girls than girls who had not taken up the offer of vaccination from baseline to follow-up although the vaccination receipt analyses were not powered to detect a significant effect ($F(1,5)=4.76$, $p=.08$, partial $H^2=.01$, power 44%). There was a significant difference in the change in feelings of risk of cervical cancer between baseline and follow-up ($F(1,5)=12.00$, $p=.02$, partial $H^2=.02$, power 69%; Table 7.8). Vaccinated girls had lowered their feelings of risk to a greater extent than girls who had not taken up the offer of vaccination. An interaction effect was found suggesting that regression slopes were not homogeneous and that the model was only true of one group. When this was explored graphically, it was evident that only those who received the vaccine changed their feelings of risk of cervical cancer. Regardless of original levels of feelings of risk, vaccinated individuals reduced their perceived risk to the same level, whereas girls who had not taken up the offer of vaccination did not change their feelings of risk. There was no greater change in feelings of risk of STIs in vaccinated girls than in girls who had not taken up the offer of vaccination from baseline to follow-up but this analysis was not sufficiently powered ($F(1,5)=6.21$, $p=.06$, partial $H^2=.04$, power 49%; Table 7.8).

Table 7.8: Feelings of risk for vaccinated girls and girls who had not taken up the offer of vaccination

	Feelings of risk for HPV mean (se)				Feelings of risk for cervical cancer mean (se)				Feelings of risk for STIs mean (se)			
	Baseline	**Follow-up**	**Change score**	**P [a]**	**Baseline**	**Follow-up**	**Change score**	**P [b]**	**Baseline**	**Follow-up**	**Change score**	**P [c]**
Vaccination status				.08				.02				.06
Vaccinated	2.41 (.12)	1.48 (.10)	.93 (.08)		2.45 (.09)	1.58 (.07)	.88 (.05)		2.12 (.05)	1.58 (.16)	.55 (.15)	
Declined vaccination	2.12 (.08)	1.63 (.08)	.49 (.04)		2.12 (.08)	1.71 (.09)	.41 (.03)		1.97 (.09)	1.50 (.07)	.48 (.08)	

[a] R^2=.16, n=399. Difference in follow-up scores between vaccinated girls and those who declined vaccination, adjusted for baseline feelings of risk for HPV.
[b] R^2=.13, n=399. Difference in follow-up scores between vaccinated girls and those who declined vaccination, adjusted for baseline feelings of risk for cervical cancer
[c] R^2=.07, n=397. Difference in follow-up scores between vaccinated girls and those who declined vaccination, adjusted for baseline feelings of risk for STIs

Did sexual behaviour change following the receipt of HPV vaccination to a greater extent than girls who did not take up the offer of vaccination?

It was then considered whether vaccinated girls had changed their sexual behaviour following HPV vaccination to a greater extent than girls who had not taken up the offer of vaccination. Sexual debut, age of sexual debut, number of sexual partners and condom use were measured. It was not possible to perform this analysis for sexual debut, age of sexual debut and number of sexual partners for the whole sample but the descriptive statistics for these variables have been presented.

Sexual debut and age of sexual debut

For the whole sample 45.7% had reached sexual debut at follow-up. As can be seen from Table 7.9, at baseline 29.6% of the girls who remained unvaccinated at follow-up had reached sexual debut compared with 34.5% of vaccinated girls. At follow-up 42.0% of girls who did not take up the offer of vaccination had reached sexual debut compared with 47.6% of vaccinated girls. The average age of sexual debut among sexually active girls was 15.7 years.

Table 7.9: Vaccination receipt by whether the participant had reached sexual debut at baseline and follow-up (n=395)

	Reached sexual debut at baseline n (%)	**Reached sexual debut at follow-up** n (%)
Declined vaccination	74 (29.6)	105 (42.0)
Vaccinated	50 (34.5)	69 (47.6)

Did the girls' number of sexual partners change following receipt of the vaccination to a greater extent than girls who did not take up the offer of vaccination?

As most girls had not reached sexual debut, the median number of sexual partners was 0. As the sample was split at the median the analysis comparing differences in changes in number of sexual partners using the whole sample would in essence be the same as

exploring changes in having reached sexual debut (which itself could not be performed for reasons described in the analysis section). Instead it was decided to explore changes in number of sexual partners in participants who were already above the median number of sexual partners at baseline (i.e. were sexually active). The rationale for this analysis was the theoretical suggestion that behaviour change may only occur in girls who were already engaging in sexual activities prior to HPV vaccination. This analysis was not possible using the dichotomous variable and so a complex samples GLM was run using original data, although caution must be taken as the data used were not normally distributed.

At follow-up, vaccinated girls (who were sexually active at baseline) had an average of 2.64 sexual partners and unvaccinated girls had an average of 2.49 sexual partners. There was no greater change in the number of sexual partners in vaccinated girls than in girls who had not taken up the offer of HPV vaccination from baseline to follow-up (Table 7.10; $F(1,3)=1.32$, $p=.33$, partial $H^2<.01$, power 24.5%). There was no interaction between baseline number of sexual partners and vaccination receipt at follow-up suggesting that the regression slopes in the model were homogeneous.

Table 7.10: Difference in number of sexual partners at follow-up for vaccinated girls and girls who had not taken up the offer of HPV vaccination, in girls who were sexually active at baseline.

	Number of sexual partners mean (se)			
	Baseline	**Follow-up**	**Change score**	**p [a]**
				.33
Declined vaccination	1.97 (.13)	2.49 (.17)	-.51 (.03)	
Vaccinated	2.23 (.14)	2.64 (.24)	-.40 (.12)	

[a] $R^2=.82$, n=117. Difference in number of sexual partners between vaccinated girls and those who declined vaccination, adjusted for baseline number of sexual partners.

Did condom use change following the receipt of HPV vaccination to a greater extent than girls who did not take up the offer of vaccination?

Of the girls who had ever had sex (n=174) 6.5% never used condoms and 35.9% used condoms every time they had sexual intercourse (38.5% of those who reported ever using condoms). Of those who had inconsistent condom use at follow-up 67% had received the vaccine and this was 62% of those who had opted not to receive the vaccine (Table 7.11). Vaccinated girls were no more likely to have changed their condom use than girls who had not taken up the offer of HPV vaccination ($F(1,3)=.47$, $p=.54$, partial $H^2<.01$, power 6.5%). This result remained true when adjusting for factors that are known to affect condom use. It was not possible to generate residuals for the complex samples logistic regression; in the absence of these cluster-adjusted residuals a non-clustered logistic regression was run. Of the standardised residuals for the non-clustered logistic regression 6.9% were greater than 2 suggesting that the model may not have been the best fit to the data. One case had a Cook's distance of >1 and a DFBeta >1 indicating that this case was influencing the model more than any other case, the results of this analysis did not differ if this case was removed so it was retained in the analysis (data not reported).

Given the non-significant findings for condom use in the whole sample, I then explored whether condom use changed in those who were already engaging in unprotected sex at baseline (n=116). Again, due to non-normally distributed data I ran parametric tests on non-parametric data (ANCOVAs). Table 7.12 shows that among girls who were using condoms inconsistently at baseline, those who received the vaccine were no more likely to have changed their condom use than girls who had not taken up the offer of HPV vaccination. This result remained true when adjusting for factors that are known to affect condom use. Interaction effects were not significant indicating that regression slopes were homogenous.

Table 7.11: Condom use at follow-up for vaccinated girls and girls who had not taken up the offer of HPV vaccination.

	Inconsistent condom use n (%)	Uses condoms every time n (%)	Change score [a] mean (se)	OR [b] (95% CI)	OR [c] (95% CI)
Declined vaccination	62 (62.0)	38 (38.0)	.42 (.12)	Reference	Reference
Vaccinated	45 (67.2)	22 (32.8)	.56 (.20)	1.14 (.76-1.72)	1.10 (.68-1.77)

[a] Unadjusted, for continuous data
[b] Odds ratio for being in the high versus low condom use group. Adjusted for baseline condom use
[c] Odds ratio for being in the high versus low condom use group. Adjusted for baseline condom use and follow-up measurement of pill use, parental subjective norms for condoms and friend subjective norm for condoms. Nagelkerke's pseudo R^2=.49, n=130.

Table 7.12: Condom use at follow-up for vaccinated girls and girls who had not taken up the offer of HPV vaccination, using girls who were engaging in unprotected sex at baseline.

	Condom use mean (se)				
	Baseline	Follow-up	Change score [a]	P [b]	P [c]
				.54	.47
Declined vaccination	2.92 (.28)	2.87 (.13)	.06 (.16)	-	-
Vaccinated	2.27 (.15)	2.24 (.03)	.03 (.13)	-	-

[a] Unadjusted
[b] Differences in condom use at follow-up between vaccinated girls and those who declined vaccination, adjusted for baseline condom use
[c] Differences in condom use at follow-up between vaccinated girls and those who declined vaccination, adjusted for baseline condom use and follow-up measurement of pill use, parental subjective norms for condoms and friend subjective norm for condoms

Did communication about sex with parents change after the receipt of HPV vaccination to a greater extent than girls who did not take up the offer of vaccination?

The girls had discussed a median of 4 topics about sex with their parents at follow-up (possible range: 0-5). Of the girls who had low communication about sex with their parents (below the median) 57.4% were vaccinated and this figure was 52.3% of those who opted not to receive the vaccine (Table 7.13). There was no difference in change in communication about sex with parents between girls who were vaccinated or girls who did not take up the offer of HPV vaccination and this remained the case when demographic characteristics were controlled for ($p>.05$). Change scores indicated that both groups increased their communication about sex with their parents over the study period. It was not possible to generate residuals for the complex samples logistic regression; in the absence of these cluster-adjusted residuals a non-clustered logistic regression was run. Fewer than 5% of the standardised residuals for the non-clustered logistic regression were greater than 2 and <1% were above 2.5 suggesting that the model was a good fit to the data. One of the DFBeta scores was >1 indicating that this case was influencing the model more than others. Removing this case did not change the results (data not shown) so it was retained in the model. None of the Cook's distance scores were >1.

Table 7.13: Communication about sex with parents at follow-up for vaccinated girls and girls who had not taken up the offer of HPV vaccination.

	Low communication n (%)	**High communication n (%)**	**Change score [a] mean (se)**	**OR [b] (95% CI)**	**OR [c] (95% CI)**
Declined vaccination	134 (52.3)	122 (47.7)	-.15 (.06)	Reference	Reference
Vaccinated	81 (57.4)	60 (42.6)	-.32 (.05)	1.15 (.82-1.61)	1.43 (.80-2.53)

[a] Unadjusted, for continuous data
[b] Odds ratio for being in the low versus high communication group. Adjusted for baseline communication about sex.
[c] Odds ratio for being in the low versus high communication group. Adjusted for baseline communication about sex, ethnicity, religion, whether the participant was practising that religion, EMA receipt and age. Nagelkerke's pseudo R^2=.49, n=368.

Did intentions to attend cervical cancer screening in the future change following the receipt of HPV vaccination to a greater extent than girls who did not take up the offer of vaccination?

The girls had a median intention to attend for cervical cancer screening in the future of 3 at follow-up (possible range 0-4). Around 17% of girls who were below the median in their intention to attend for cervical cancer screening (low intention) had received the HPV vaccine compared with 18% of those who opted not to receive the vaccine (Table 7.14). There was no change in cervical cancer screening attendance intentions in vaccinated girls (or girls who did not take up the offer of HPV vaccination) and this finding remained true when adjusting for demographic factors. It was not possible to generate residuals for the complex samples logistic regression; in the absence of these cluster-adjusted residuals a non-clustered logistic regression was run. Fewer than 5% of the standardised residuals for the non-clustered logistic regression were greater than 2 and less than 1% were above 2.5 suggesting that the model was a good fit to the data. One of the Cook's distance scores and seven DFBeta scores were >1 indicating that these cases were influencing the model more than others, removing these cases caused the model to become unstable (certain cells became empty) meaning that the models could not be run. As a result these cases were retained in the model but it was acknowledged that they could be significantly influencing the results.

Table 7.14: Intentions to attend for cervical cancer screening in the future at follow-up for vaccinated girls and girls who had not taken up the offer of HPV vaccination.

	Low intention n (%)	**High intention n (%)**	**Change score [a] mean (se)**	**OR [b] (95% CI)**	**OR [c] (95% CI)**
Declined vaccination	46 (18.0)	210 (82.0)	-.07 (.04)	Reference	Reference
Vaccinated	25 (17.0)	122 (83.0)	.01 (.08)	1.04 (.49-2.22)	1.48 (.63-3.51)

[a] Unadjusted, for continuous data
[b] Odds ratio for having a low versus high intention. Adjusted for baseline intentions.
[c] Odds ratio for having a low versus high intention. Adjusted for baseline intentions, ethnicity, religion, whether the participant was practising that religion, EMA receipt and age. Nagelkerke's pseudo R^2=.31, n=373.

Summary of findings for the prospective study

This study followed a group of girls aged 16-18 years old over time. All girls were unvaccinated at baseline. Between baseline and follow-up the girls were offered the HPV vaccine as part of the childhood immunisation schedule ('catch-up programme') and, as a result, at follow-up assessment had either received the HPV vaccine or opted not to do so. The study was designed to explore whether receipt of the HPV vaccine was associated with adolescent girls' sexual behaviour and attitudes. Vaccinated girls showed reduced risk perceptions of cervical cancer following HPV vaccination. There was no difference in change in the number of sexual partners a girl had for girls who were already sexually active at baseline or difference in change in condom use for the whole sample or those who were inconsistently using condoms before vaccination. There was also no difference in change in parental communication about sex or intentions to attend for cervical cancer screening in the future following HPV vaccination.

STUDY 2 – A QUASI CROSS-SECTIONAL STUDY

Study 2 was a quasi cross-sectional study and was designed to explore the effect of HPV vaccination receipt, accounting for the effect of the immunisation programme generally. This had not been possible in the prospective study. The immunisation programme has been accompanied by significant educational and advertising campaigns that unvaccinated girls will have been exposed to as well as those who opted to receive the vaccine, so it is important to understand whether it is the programme itself that affects adolescents rather than the receipt of HPV immunisation. As described in Chapter 1, the HPV 'catch-up' programme was rolled out quickly which made impossible to concurrently recruit one group who had been offered the vaccine and one group who had not. Another important consideration was that age was controlled for, as normal levels of sexual behaviour are likely to differ at varying ages, especially in adolescent girls.

In order to overcome these problems a group of year 12 girls (usually aged 16-17) were recruited and completed questionnaires in March 2009 before the HPV vaccine was

available to them as part of the 'catch-up' programme[20]. This group was use as a 'control cohort'. They were compared with the group of girls who participated at follow-up in Study 1 (the prospective study), who were vaccinated and of the same age as the control cohort (also in school-year 12). The data from the vaccinated girls was collected exactly one year later than when the control cohort participated (March 2010) so that normal levels of sexual behaviour could be controlled for. This quasi cross-sectional study looked at whether there were any differences in risk perceptions, sexual behaviours, communication about sex with parents and intentions to attend for cervical cancer screening in the future between vaccinated girls and the equivalent control cohort of unvaccinated girls.

Hypothesis

The existing literature described in this chapter and theory outlined in Chapter 3 allowed a number of hypotheses to be drawn for the present study.

1. Girls who receive the HPV vaccine will have lower perceived risk of HPV, cervical cancer and other STIs than girls who have not been offered the HPV vaccine.
2. Girls who have received the HPV vaccine will be engaging in different sexual behaviour than girls who have not been offered the HPV vaccine.
3. Girls who have received the HPV vaccine will speak to their parents about sex more than girls who have not been offered the HPV vaccine.
4. Girls who have received the HPV vaccine will be less likely to intend to attend for cervical cancer screening in the future than girls who have not been offered the HPV vaccine.

Methods

Participants, procedures and measures

The recruitment of the vaccinated group was detailed in the methods section of the prospective study reported earlier in this chapter. In brief, girls were selected for analysis in this quasi cross sectional study (Study 2) if they participated at follow-up in the

[20] At this time the HPV immunisation programme was underway, however the vaccine was not yet being offered to these girls. Accordingly these girls were unvaccinated, unless they had received the vaccine privately. Girls who reported they had received the vaccine privately were excluded.

prospective study, had indicated that they had received the HPV vaccine and were in school year 12 (see Table 7.15 for detailed inclusion criteria). The responses to the follow-up questionnaire detailed in the prospective study were used for analysis. My role in this study was identical to that described for the prospective study.

In March 2009, the control cohort was recruited from the same eight colleges used in the prospective study (Study 1). The procedures adopted at baseline in the prospective study were also adopted for this quasi cross-sectional study. Most measures comprising the control cohort questionnaire were identical to those used for the baseline questionnaire in the prospective study (see Appendix 17 for control cohort questionnaire). Vaccination receipt was measured differently from baseline: the control cohort was asked to respond to a yes/no question asking whether they had received the HPV vaccine. A simple dichotomous response was used as the vaccine was not yet available to these girls as part of the NHS programme and it was anticipated that very few girls would have received the vaccine privately. This item was developed for the present study.

For the communication about sex scale the Cronbach's α for the control cohort=.79 and for the vaccinated cohort=.79 and for the variable assessing intentions to attend for cervical screening the Cronbach's α for the control cohort=1.0 and for the vaccinated cohort =.90.

Table 7.15 – Inclusion criteria for each group

Pre-vaccination programme control cohort	**Vaccinated**
Recruited in March 2009	Recruited at follow-up (March 2010)
In school year 12	In school year 12
≤ 18 years old [a]	≤ 18 years old
Had not been offered or received the HPV vaccine	Had received at least one dose of the HPV vaccine at follow-up

[a] Respondents who were over the age of 18 were excluded as they were not entitled to receive the HPV vaccine as part of the national immunisation programme (n=25 of all participants).

Analysis

Sample size calculations, response rate calculations and procedures for handling missing data were identical to those used in the prospective study. The proportion of missing data for the vaccinated group has been detailed in the methods for the prospective study. For the control cohort, 2 cases had >50% data missing so were excluded. The percentage of missing data for the control group for each variable can be found in Appendix 19.

Statistical analysis

Statistical analysis was performed using SPSS version 14 (SPSS Inc., 2005). The dependent variables were identical to those used for the prospective study: risk perceptions, sexual behaviour, communication about sex with parents and intentions to attend cervical screening in the future. A number of the dependent variables showed statistically significant skewness and kurtosis. As the values for these variables were meaningful it was decided not to transform this data and to dichotomise non-normally distributed dependent variables. As with the variables in the prospective study, a median split was used for number of sexual partners (dichotomised into number of sexual partners at or below the median versus number of sexual partners above the median; median=0), number of topics about sex discussed with parents (dichotomised into number at or above the median – 'high communication about sex' versus number below the median – 'low communication about sex'; median=3, range 0-5) and intention to attend for cervical cancer screening in the future (dichotomised into intention below the median – 'low intention' versus intention at or above the median – 'high intention'; median=3, range 0-5). Condom use was dichotomised into 'always uses condoms' versus all other responses as this was considered most meaningful (inconsistent condom use of any kind increases risk of pregnancy/STI infection).

In order to examine whether there were differences between vaccinated girls and the equivalent pre-vaccination programme control cohort I ran complex samples analysis of variance (ANOVAs) or ANCOVAs as general linear models for continuous dependent variables and complex sample logistic regression models for dichotomous dependent variables (I used the same statistics as the ones run for the prospective study for both

analytical methods). I ran two models. In the first I included just vaccination receipt as an independent variable. In the second model I also included factors that were established in the literature to be related to the dependent variable and included just demographic characteristics for the analysis exploring cervical cancer screening intentions and communication about sex with parents (detailed in the methods section of the prospective study). It was not possible to run analysis comparing differences in number of sexual partners for the whole sample as splitting the sample at the median (0) meant that this analysis would again attempt to look at differences in whether respondents had reached sexual debut and so could not be performed.

Results

Response rate

Data collected at follow-up have been described in the results for the prospective study. 665 girls completed the control group questionnaire. Data from 811 girls were included in the analysis (n=592 from the control cohort and n=219 vaccinated girls from the follow-up cohort[21]). For the control group assessment the number of participants recruited from each college ranged from 17 to 302, the range at follow-up was from 16 to 542 (Table 7.16). For both groups, the majority of participants came from College 1 (Table 7.16).

Of the girls who were registered in the colleges, 49% completed the questionnaire when the control cohort were recruited and 45.4% participated at follow-up, giving an overall response rate of 46.9%, inclusive of the response rates for College 2 and College 4 (which did not provide participants for follow-up assessment). Of the girls who were present in the data collection sessions 95.0% participated when the control group were recruited and 97.9% participated at follow-up. Overall, including the response rates for College 2 and College 4, 96.7% of girls present in the sessions completed the questionnaire. As described in the methods section for the prospective study, the denominators for the number of girls

[21] The reduction in sample size for the number of girls recruited at follow-up to the number included in the analysis is due to the analysis requiring that the girls were both vaccinated and in school year 12 (usually aged 16-17).

registered in the colleges was unlikely to be accurate, as a consequence it was concluded that the overall response rate for the study was between 46.9% and 96.7%.

Table 7.16 – College response rates

	College								
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**Total**
Response rate Denominator= number attending session									
Control group N (%)	302 (94.2)	29 (100)	29 (82.9)	101 (100)	61 (91.0)	87 (91.6)	17 (100)	39 (100)	665 (95.0)
Follow-up N (%)	542 (98.0)	No participants	16 (100)	Not recruited	39 (100)	142 (91.0)	29 (100)	68 (98.6)	836 (97.9)
Total N (%)	844 (96.1)	29 (100)	45 (91.5)	101 (100)	100 (95.5)	229 (91.3)	46 (100)	107 (99.3)	1501 (96.7)[a]
Response rate Denominator= number registered in college									
Control group N (%)	302 (62.9)	29 (56.8)	29 (30.2)	101 (28.7)	61 (55.5)	87 (79.1)	17 (9.1)	39 (69.6)	665 (49.0)
Follow-up N (%)	542 (76.3)	No participants	16 (12.3)	Not recruited	39 (22.0)	142 (65.1)	29 (8.1)	68 (88.3)	836 (45.4)
Total N (%)	844 (69.6)	29 (56.8)	45 (21.3)	101 (28.7)	100 (38.8)	229 (72.1)	46 (8.6)	107 (79.0)	1501 (46.9)[a]

[a] Total includes the response rate for College 2 and College 4.

Description of the sample

Most participants were white (62%), 55% were not entitled to EMA, the average age was 17.3 years, 40% were Muslim and 46% were practising a religion (Table 7.17).

Table 7.17: Demographic characteristics

n=811	**n (%)**
Ethnicity	
White	486 (62.0)
Black	82 (10.5)
Asian	136 (17.3)
Other	80 (10.2)
EMA receipt	
£30	156 (20.0)
£20	37 (4.7)
£10	157 (20.1)
No entitlement	431 (55.2)
Religion	
None	293 (37.3)
Christian	106 (13.5)
Muslim	311 (39.6)
Other	75 (9.6)
Practising a religion [a]	
Yes	216 (46.2)
No	252 (53.8)
Age (mean (se)	17.3 (.05)

Note: Total columns not equalling the total for sample are due to missing data, percentages not equalling 100% are due to missing data.
[a] Of those who reported a having a religion

Do vaccinated girls' perceptions of risk differ from the pre-vaccination programme control cohort?

First it was considered whether vaccinated girls differed from the pre-vaccination programme control cohort in their perceived risk of HPV, cervical cancer and STIs. The 'feelings of risk' measurement of perceived risk was used for this analysis. For the whole sample feelings of risk were low: HPV mean=2.03, se=.03; cervical cancer mean=2.05, se=.03; STIs mean=1.92, se=.03 (possible range 0-4). Feelings of risk for HPV were lower in vaccinated individuals than in the control cohort ($F(1,7)=333.0$, $p<.01$, partial $H^2=.14$, power 100%; Table 7.18), as were feelings of risk for cervical cancer ($F(1,7)= 201.23$, $p<.01$, partial $H^2=.10$, power 100%; Table 7.18) and feelings of risk for STIs ($F(1,7)=67.83$, $p<.01$, partial $H^2=.02$, power 99.4%; Table 7.18). The R^2 statistic showed that vaccination status alone could explain 14% of the variance in feelings of risk of HPV infection, 10% for

cervical cancer feelings of risk and 2% of the variance in feelings of risk of STIs. It was not possible to report whether homogeneity of variance had been violated in the complex samples analysis as this was not an option in the statistical package used for analysis and exploring homogeneity of variance using a simple ANOVA would not have taken the clustering into account. This was the case for all GLM analysis performed.

Table 7.18: Differences in feelings of risk between vaccinated girls and the pre-vaccination programme control cohort.

	Feelings of risk for HPV Mean (se)	Feelings of risk for cervical cancer mean (se)	Feelings of risk for STIs mean (se)
Vaccinated	1.47 (.05)* [a]	1.59 (.06)* [b]	2.00 (.00)* [c]
Pre-vaccination programme cohort	2.23 (.07)	2.22 (.06)	2.09 (.05)

* Difference between vaccinated girls and the pre-vaccination programme cohort p<.01
[a] R^2=.14, n=800
[b] R^2=.10, n=799
[c] R^2=.02, n=794

Does vaccinated girls' sexual behaviour differ from the pre-vaccination programme control cohort?

It was then considered whether there were differences between vaccinated girls and the pre-vaccination programme control cohort in terms of their sexual behaviour. Sexual debut, age of sexual debut and condom use was examined. Number of sexual partners was not examined as the median number of sexual partners was 0 and so this analysis would have been a replication of the sexual debut analysis.

Do vaccinated girls' differ from the pre-vaccination programme control cohort in whether they have reached sexual debut?

For the whole sample 58.1% of girls had not reached sexual debut. Of the control cohort, 42.5% had reached sexual debut compared with 40.9% of vaccinated girls. In the unadjusted model vaccinated girls were no more likely to have reached sexual debut than the control cohort (OR: .94, CI: .71-1.24; Table 7.19). This remained the case when

adjusting for factors that are known to affect sexual debut. For the full model, Nagelkerke's pseudo R^2 indicated that 34% of the variance in sexual debut could be explained. Fewer than 5% of the standardised residuals for the non-clustered logistic regression were greater than 2 and no more than 1% were above 2.5 suggesting that the model was a good fit to the data. Two of the Cook's distance scores were greater than 1 indicating that these cases were influencing the model over and above any other case so these cases were removed from the analysis. None of the DFBeta scores were greater than 1.

Table 7.19: Differences in whether participants had reached sexual debut between vaccinated girls and the pre-vaccination programme control cohort.

	Reached sexual debut?			
	No	**Yes**	**OR [a]**	**OR [b]**
	n (%)	**n (%)**	**(95% CI)**	**(95% CI)**
Pre-vaccination programme cohort	333 (57.5)	246 (42.5)	Reference	Reference
Vaccinated	123 (59.1)	85 (40.9)	.94 (.71-1.24)	.77 (.57-1.04)

[a] Odds ratio for yes versus no
[b] Odds ratio for yes versus no. Adjusted for having ever had a boyfriend, drug use, parental subjective norms for sex and friend subjective norm for sex. Nagelkerke's pseudo R^2=.34, n=747.

Do vaccinated girls differ from the pre-vaccination programme control cohort in their age of sexual debut?

In girls who had reached sexual debut, the average age of sexual debut was 15.4 years. The mean age of sexual debut for vaccinated girls was 15.44 and this was similar for the control cohort (15.43; Table 7.20). Age of sexual debut was not associated with vaccination receipt ($F(1,6)=.01$, $p=.92$, partial $H^2 <.01$, power 5.0%) and this continued to be the case when controlling for factors known to be associated with age of sexual debut ($F(1,6)=.20$, $p=.67$ partial $H^2 <.01$, power 5.3%). However the number of participants in each group was

not large enough to be sufficiently powered to detect the reported effect size were it genuinely correct.

Table 7.20: Differences in age of sexual debut between vaccinated girls and the pre-vaccination programme control cohort.

	Age of sexual debut Mean (se)	p [a]	p [b]
Vaccination status		.92	.67
Pre-vaccination programme cohort	15.43 (.07)		
Vaccinated	15.44 (.02)		

[a] Unadjusted
[b] Adjusted for smoking status and whether respondent had ever had a boyfriend. R^2=.10, n=329.

Do vaccinated girls differ from the pre-vaccination programme control cohort in their condom use?

Of the girls who had ever had sex (n=331) 6.3% never used condoms when they had sexual intercourse and 37.4% used condoms every time (39.9% of those who reported ever using condoms). Around 70% of girls who had inconsistent condom use were vaccinated, compared with 62% of those in the control cohort (Table 7.21). Vaccinated girls were marginally more likely to have inconsistent condom use than the control cohort (p=.05, OR: 1.42, CI: 1.01-1.99), but this result did not remain true when adjusting for factors that are known to affect condom use. Greater than 5% of the standardised residuals for the non-clustered logistic regression were greater than 2 and 3.7% were above 2.5 suggesting that the model may not have been the best fit to the data. None of the Cook's distance scores nor the DFBeta scores were >1 indicating that no case was influencing the model more than any other.

Table 7.21: Differences in condom use between vaccinated girls and the pre-vaccination programme control cohort.

	Inconsistent condom use n (%)	Uses condoms every time n (%)	OR [a] (95% CI)	OR [b] (95% CI)
Pre-vaccination programme cohort	150 (62.0)	92 (38.0)	Reference	Reference
Vaccinated	60 (69.8)	26 (30.2)	1.42* (1.01-1.99)	1.57 (.97-1.57)

[a] Unadjusted odds ratio for low versus high condom use
[b] Odds ratio for low versus high condom use, adjusted for pill use, parental subjective norms for condom use and friend subjective norm for condom use. Nagelkerke's pseudo R^2=.19, n=317.
* p=.05

Do vaccinated girls differ from the pre-vaccination programme control cohort in their communication about sex with their parents?

The next analysis considered whether vaccinated girls differed from the control cohort in the extent that they had communicated about sex with their parents. For the whole sample, the girls had discussed a median of 3 topics about sex with their parents (possible range 0-5). Of the girls who had low communication about sex with their parents 37.0% were vaccinated against HPV, compared with 44.1% of those in the control cohort (Table 7.22). Vaccination status could not predict whether girls had high communication about sex with their parents and this remained the case when demographic characteristics were controlled for (p>.05). Fewer than 5% of the standardised residuals for the non-clustered logistic regression were greater than 2 but 3.7% were above 2.5 suggesting that the model may not have been the best fit to the data. One of the Cook's distance scores and four DFBeta scores were >1 indicating that these cases were influencing the model more than others, removing these cases caused the model to become unstable (certain cells became empty) meaning that the models could not be run. As a result these cases were retained in the model but it was acknowledged that they could be significantly influencing the results.

Table 7.22: Differences in communication about sex with parents between vaccinated girls and the pre-vaccination programme control cohort.

	Low communication n (%)	High communication n (%)	OR [a] (95% CI)	OR [a] (95% CI)
Pre-vaccination programme cohort	258 (44.1)	327 (55.9)	Reference	Reference
Vaccinated	81 (37.0)	132 (60.3)	.78 (.54-1.12)	.87 (.61-1.23)

[a] Unadjusted odds ratio for low versus high communication.
[b] Odds ratio for low versus high communication adjusted for ethnicity, religion, whether the respondent is practising that religion, EMA entitlement and age. Nagelkerke's pseudo R^2=.17, n=534.

Do vaccinated girls differ from the pre-vaccination programme control cohort in their intention to attend cervical cancer screening in the future?

Finally it was considered whether there were differences between vaccinated girls and the pre-vaccination programme control cohort in their intentions to attend for cervical cancer screening in the future. For the whole sample the girls had a median intention to attend for cervical cancer screening in the future of 3 (possible range 0-4). Of the girls who had low intentions 38% were vaccinated, compared with 44.4% of those in the control cohort (Table 7.23). Vaccinated girls were less likely to have low intentions to attend for cervical cancer screening than the pre-vaccination programme control cohort (p=.03, OR: .71, CI: .54-.95). This relationship did not remain significant when demographic characteristics were adjusted for. Fewer than 5% of the standardised residuals for the non-clustered logistic regression were greater than 2 and none were above 2.5 suggesting that the model was a good fit to the data. None of the Cook's distance scores were >1 however four DFBeta scores were >1 indicating that these cases were influencing the model more than others, removing these cases caused the model to become unstable (certain cells became empty) meaning that the models could not be run. As a result these cases were retained in the model but it was acknowledged that they could be significantly influencing the results.

Table 7.23: Differences in intention to attend for cervical cancer screening between vaccinated girls and the pre-vaccination programme control cohort.

	Low intention n (%)	High intention n (%)	OR [a] (95% CI)	OR [b] (95% CI)
Pre-vaccination programme cohort	135 (23.2)	448 (76.8)	Reference	Reference
Vaccinated	38 (17.7)	177 (82.3)	.71 (.54-.95)*	.95 (.77-1.18)

[a] Unadjusted odds ratio for low versus high intention.
[b] Odds ratio for low versus high intention adjusted for ethnicity, religion, whether the respondent is practising that religion, EMA entitlement and age. Nagelkerke's pseudo R^2=.08, n=534.
* p=.03

Summary of the findings for the quasi cross-sectional study (Study 2)

This quasi cross-sectional study explored whether vaccinated girls differed from a pre-vaccination programme control cohort of girls recruited before they had been offered the HPV vaccine. The girls were of the same age (school year 12) but were recruited exactly one year apart; in March 2009 for the control cohort and in March 2010 (follow-up) for the vaccinated group. The study was designed to examine whether receipt of the HPV vaccine had any effect on adolescent girls' behaviour and attitudes, accounting for the effect of the HPV immunisation programme itself. Vaccinated girls were found to have lower feelings of risk for HPV, cervical cancer and of STIs than the pre-vaccination programme control cohort. There was no difference between vaccinated girls and control cohort in age of sexual debut or whether they had reached sexual debut and there was no difference in condom use when factors known to affect condom use were taken into account. Similarly, there was no difference in communication about sex with parents. Vaccinated girls were less likely to have low intentions to attend for cervical cancer screening in the future than the control cohort in univariate analysis.

DISCUSSION

In this chapter I have presented two studies that explored the effect of HPV vaccination, on the sexual behaviour of 16-18 year old girls. The studies also examined the effect of vaccination on girls' communication about sex with their parents and on their intentions to

attend for cervical cancer screening in the future. Girls from eight colleges across London and the South East of England participated in a prospective study, which informed us about the effect of vaccination and a quasi cross-sectional study which could account for the effect of the programme itself. The prospective study showed that uptake of the vaccine was generally below optimal levels across the colleges. The quasi cross-sectional study found that vaccinated girls showed lowered perceptions of risk for cervical cancer and thought that they were less likely to be infected with HPV or with other STIs than an equivalent pre-vaccination programme control cohort of girls. The findings from both studies showed that there was no negative effect of vaccination, even when accounting for the effect of the immunisation programme itself, on sexual behaviour, even in the most 'at risk' groups, and no negative effect on cervical cancer screening intentions. The studies also showed that vaccination was not being used by parents as a 'teachable moment' to discuss sex with their daughters.

In the quasi cross-sectional study vaccinated girls were no more likely than the control cohort to have reached sexual debut. This was contrary to the hypothesis outlined in this chapter and to Read et al's (2010) finding that intentions to receive the vaccine were 2.2 times higher in sexually active girls who were mainly from minority ethnic groups in the USA. However, Neubrand et al. (2009) have also found no association between being sexually active and completion of the HPV vaccination series. Age of sexual debut did not differ between vaccinated girls and the control cohort, in discordance with the hypothesis stated in the introduction to this chapter. However, a prospective study conducted with 13-26 year old American girls also reported null findings (Conroy et al., 2009). Around 43% of girls in the prospective study and 42% of girls in the quasi cross-sectional study had reached sexual debut and the median number of sexual partners was 0 for both studies. The prospective study showed that there was no difference in change in number of sexual partners in vaccinated girls relative to girls who had opted not to receive the vaccine for girls who were sexually active at baseline, contrary to as was hypothesised.

Of concern was that most sexually active girls were inconsistently using condoms or not using them at all. However, the prospective study showed that vaccinated girls were no

more likely to have changed their condom use following HPV vaccination than unvaccinated girls (not hypothesised) and this was also the case when considering only girls who at baseline were inconsistently using condoms, contrary to as was hypothesised. The quasi cross-sectional study showed that there was no difference between vaccinated girls and the control cohort in condom use when factors known to affect condom use were taken into account, in disagreement with the hypothesis. In 2008/2009 a government commissioned national survey in the UK found 70% of women aged 16-24 who said that they used condoms reported using them every time they had sex (Office for National Statistics, 2009), compared with 38.5-39.9% in the current samples, suggesting that consistent condom use in these studies was considerably lower than in the general population. If these samples were engaging in more instances of unprotected sex than the general population, in accordance with the hypothesis outlined in the introduction, these more 'at risk' girls should have been more likely to have further reduced their condom use following vaccination, but this was not found in the prospective study. Although the figures for the national sample may not be directly comparable to the present studies as they refer to a wider age group.

If the results of these two studies are correct, they are reassuring as it appears that neither HPV vaccination nor the programme itself have negatively affected girls' sexual behaviour and may go some way to alleviate parents' concerns about girls' sexual behaviour following HPV vaccination that have been described throughout this thesis: concern about providing implicit approval for sexual activity (for example, Waller et al., 2006) and concern about disinhibition because girls perceived their risk of STIs to have reduced (for example, Ogilvie et al., 2010). The findings contradict girls' and adult women's beliefs about changes in their own or others' sexual behaviour following HPV vaccination (Brabin et al., 2010; Gottvall et al., 2009; Short et al., 2010). Vaccinated girls have not started to engage in sexual activities because they perceive that the HPV vaccine being available to them implies that they should be sexually active (no difference in number of girls who had reached sexual debut between vaccinated girls and the control cohort in the quasi cross-sectional study) nor have they become more risky in their sexual behaviours (no difference in change in condom use or number of sexual partners in the prospective study) or are any different from the those who had not been offered vaccination in the risky sexual

behaviours that they do engage in (no difference in consistency of condom use, age of sexual debut or whether they had ever had sex). The results also suggest that vaccinated girls who were already engaging in risky sexual behaviour are no more likely to have changed their sexual behaviour than girls who opted not to receive the vaccine as was concluded as a possible occurrence in Chapter 3.

When measuring perceived risk, the prospective study found 'feelings of risk' to be a better predictor of behaviour than 'perceived likelihood', which concurs with the findings of Weinstein et al. (2007). None of the 'perceived likelihood' variables were related to vaccination receipt whereas 'feelings of risk' for HPV was associated and 'feelings of risk' for cervical cancer showed a similar trend. This finding has important implications for the measurement of perceived risk. It is essential that measurement tools are as accurate as possible to ensure that error and the resulting bias in findings is minimised. It appears that 'feelings of risk' is the most appropriate measure of risk perceptions of HPV when exploring subsequent preventive behaviour related to those perceptions.

The prospective study also found, as was partly hypothesised in the introduction and in support of behaviour motivation theories, that risk perceptions of HPV and cervical cancer predicted vaccination receipt. The R^2 for these analyses were small suggesting that other factors contributed to vaccination receipt also. Perceptions of risk for STIs did not predict vaccination receipt suggesting that the girls understood the reason that the HPV vaccine is being given. This appears in opposition to the existing literature that has suggested that adolescents are confused about what the HPV vaccine protects against (Mathur et al., 2010; Robbins et al., 2010). This finding makes sense in the context of the UK HPV immunisation programme as the bivalent vaccine is being used that does not protect against genital warts. Girls who are offered the quadrivalent vaccine may be more likely to become confused about the protection provided by the vaccine as the issue of STIs is raised.

In partial accordance with the hypothesis outlined in the introduction and risk compensation theory, the prospective study showed that vaccinated girls lowered their perceived risk of

cervical cancer, whereas those who declined the vaccine did not change their perceived risk. This finding supported the notion of risk-reappraisal (changes in risk perceptions following a risk altering intervention) and replicates Brewer et al.'s (2007b) Lyme disease vaccination study in which vaccinated individuals lowered their perceptions of risk. Brewer and colleagues used a 'perceived likelihood' measure of perceived risk, unlike the present study which assessed 'feelings of risk', suggesting that the existence of risk-reappraisal does not seem to be measurement-type dependent. There was no difference in change in perceived risk of HPV or STIs although neither of these analyses was powered to detect differences. The observed effect size for HPV was comparable to the effect size for cervical cancer suggesting that with greater power significant effects may have been reported for perceived risk of HPV. It is positive that perceived risk of STIs did not change in vaccinated girls relative to girls who declined vaccination, as this provided additional support for the theory that vaccinated girls are aware of the protection provided and not provided by the HPV vaccine.

The quasi cross-sectional study showed that those who were vaccinated had lower risk perceptions for HPV, cervical cancer and STIs than those who had not been offered vaccination. In accordance with the hypothesis outlined previously and risk compensation theory the adoption of a risk reducing intervention resulted in those adopting the intervention to have lower perceptions of risk than the pre-vaccination programme control cohort. Again this finding reflects Brewer et al.'s results in which they reported that those individuals vaccinated against Lyme disease had lower risk perceptions for Lyme disease than unvaccinated individuals (Brewer et al., 2007b). It is possible that the finding for perceived risk of cervical cancer was the result of the immunisation programme itself rather than receipt of the immunisation. It is likely that those in the vaccinated group (surveyed at follow-up – March 2010) had a greater understanding of the likelihood of cervical cancer diagnosis as the vaccination programme had been underway for one year longer than when the pre-vaccination programme control cohort were surveyed (March 2009) and these girls had been exposed to the promotional campaign that accompanied the roll out of the programme. As a result they may have better understood the rarity of cervical cancer and so have lower risk perceptions because of greater knowledge. However, this does not

explain the lower perceptions of risk for HPV as it is a common infection. It seems likely that this finding was due to vaccination receipt.

These explanations do not clarify the lower perceptions of risk for STIs. The questions assessing perceived risk of STIs did not specify that the STIs to be considered should not include HPV. It is possible that some participants may have recognised HPV as an STI and so responded to this question considering HPV also, which may have contributed to the significant findings for lower perceived risk of STIs in vaccinated girls than in the pre-vaccination programme control cohort. Alternatively it may be that the vaccinated girls misunderstood the protection afforded by the HPV vaccine to include other STIs which is concerning, although positively girls do not appear to be changing their sexual behaviour as a result of these possible misconceptions. Misconceptions about the protection provided by the HPV vaccine have been reported elsewhere and have included the belief that the vaccine protects against chlamydia, STIs generally, pregnancy and provides complete protection against cervical cancer (Mathur et al., 2010; Robbins et al., 2010). Although previous analysis in the prospective study exploring predictors of vaccination receipt and changes in risk perceptions following vaccination suggested that girls are not confused about what the HPV vaccine provides protection from, the quasi cross-sectional study appears to show that they are. Visually, the pre-vaccination programme cohort had much higher feelings of risk for HPV, cervical cancer and STIs than either the vaccinated group in both the prospective study and the quasi cross-sectional study or those who declined vaccination in the prospective study, suggesting that being involved in the programme (receiving or refusing vaccination) causes perceptions of risk to lower. It appears that low perceptions of risk of STIs are not a result of HPV vaccination receipt, but may be due to exposure to the programme. Vaccination co-ordinators should continue to ensure that information materials provided to girls draw attention to the fact that the vaccine does not prevent all cases of cervical cancer nor does it protect recipients from other STIs.

It appears then that there is partial support for risk-reappraisal theories in the context of HPV vaccination in that an intervention has caused a change in perceived risk. There was also evidence for part of risk compensation theory as the quasi cross-sectional study

showed that vaccinated girls had lower perceptions of risk than the pre-vaccination programme control cohort (Adams, 1985; Adams, 1988; Wilde, 1982) and evidence for behaviour-motivation theories as risk perceptions predicted vaccination receipt in the prospective study. However, there was no evidence that these reductions/differences in perceived risk influenced subsequent behaviour in the prospective study, as risk compensation theory would suggest. As a result there was also no evidence of original levels of actual risk being restored, in accordance with risk compensation theory. This finding appears to invalidate adolescents' assertions that they may engage in more risky sexual behaviour following HPV vaccination (Brabin et al., 2009; Gottvall et al., 2009); girls may have believed that they might change their behaviour but they have not acted on these beliefs.

It has been suggested that the perceived efficacy of the intervention should be considered when comparing differences in changes in perceived risk (Brewer et al., 2007a) as altered risk perceptions may be more apparent in individuals who hold high efficacy beliefs. It has not been proposed how perceived efficacy in risk perception analysis should be considered and given that the risk perception findings for the present study were as hypothesised, efficacy beliefs were not interpreted (although they were measured as part of the larger questionnaire). Similarly, behaviour motivation theories would suggest that if behaviour had changed it could have been explained by risk perceptions. As behaviour did not change the role of risk perceptions was not explored. This meant that this aspect of behaviour motivation was not tested.

Most girls in both studies were having conversations about sex with their parents. However, neither vaccination receipt, nor the immunisation programme itself were being used as a 'teachable moment' by parents to talk about other issues relating to sex as has been recommended by the World Health Organisation (2006): the prospective study showed that vaccinated girls did not increase their communication about sex relative to girls who opted not to receive the vaccine and the quasi cross-sectional study found that vaccinated girls had not spoken to their parents about sex any more than girls who had not

been offered vaccination. As around half of the sample had not yet reached sexual debut, such conversations appear still relevant with girls in this age group.

Askelson et al. (2010) reported that American parents are willing to use HPV vaccination as an opportunity to discuss sex and contraception with their daughter if they hold favourable opinions about discussing sex with their daughters and believe that people who are important to them think that is would be a good idea. It is unknown whether British parents are willing to do this, but it appears that even if they do intend to do so they are not acting on these intentions. Parents' concerns about sexual behaviour following HPV vaccination may have resulted in parents being reluctant to discuss sex with their daughters in the context of HPV vaccination so that implicit messages of approval for sexual activity are not conveyed. Educational interventions have been developed to help parents communicate with their children about sex (O'Donnell et al., 2007) and their use should be considered, as children who do not talk to their parents about sex are at an increased risk of earlier sexual debut and of adopting STI-risk behaviours, such as multiple partners and inconsistent condom use (Diiorio et al., 2003; Zimmer-Gembeck & Helfand, 2008). The offer of HPV vaccination, regardless of vaccination status may have facilitated communication about sex as the change scores in the prospective study indicated that both groups increased their communication with their parents over the study period, although the increase may have reflected the fact that follow-up measures were taken six months after baseline. This interpretation is also questionable as there was no difference in communication between vaccinated girls and those who had not been offered the vaccine. The three-dose vaccination schedule provides multiple opportunities for the discussion about sex to be continued, rather than the talk about the 'birds and the bees' being a one-off conversation and these opportunities may not be being used.

Intentions to attend for cervical cancer screening in the future were high generally. The prospective study found that vaccinated girls did not change their intentions following vaccination (relative to girls who opted not to receive the vaccine) and the quasi cross-sectional study showed that vaccinated girls were less likely to have low intentions to attend for cervical screening than the pre-vaccination programme control cohort in

univariate analysis. These findings appear to conflict with the findings of Mortensen (2010) who found vaccinated 16-26 year old Danish girls to report in focus groups that they did not think they would consistently attend for cervical cancer screening in the future and Donders et al.'s (2008) findings who showed that younger Belgian women were more likely to believe that cervical cancer screening was no longer necessary following vaccination, although this study did not consider girls who had received the vaccine. The contrast in findings from the present studies to the previous studies may be due to differences in the information materials supplied alongside the immunisation programmes in the various countries. It may be the case that the literature given to girls about the HPV vaccine by British immunisation coordinators was more comprehensive and appropriate and immunisation programmes in countries outside of the UK may benefit from adopting the materials provided to girls in the UK. It may also have been the case that the control cohort, who would not have been exposed to these information materials, were less informed about the necessity of cervical screening generally.

Limitations

The inclusion criteria for the various analysis in each study, such as having to have participated at both baseline and follow-up for the prospective study and the choice of complex sampling for analysis, meant that sample sizes were reduced considerably. In addition, two of the colleges did not complete the study meaning that their data could not be used for the prospective study, further reducing the sample size. Testa et al. (2006) in their study exploring sexual behaviour in young people also reported a school drop-out rate of 25%, and it was anticipated during recruitment that not all of the colleges would participate at each time point. 1617 girls completed a questionnaire at least once but only 407 girls were included in the prospective study analysis and 811 girls were included in the quasi cross-sectional study analysis. The inclusion criteria that caused the sample size to reduce were essential to the analysis to remove possible confounding variables that would have influenced the results and the analytical strategy was necessary to overcome violated assumptions of independence, but both meant that combined with small effect sizes that were detected, the analysis was not powered to find significant effect sizes of smaller than r=.16 (alpha=.05, power=.80, df=3, based on the lowest df reported in both studies, n=2 groups). For the lowest effect to have been detected in the present studies 1443 participants

would have been required (alpha=.05, power=.80, df=7, based on the highest df reported, n=2 groups, r=.1). Using the experience of recruitment in the prospective study (only ~25% of recruited participants were included in the analysis) around 5772 participants would have had to complete the questionnaires and up to 13,645 girls approached to participate (based on the lowest response rate). As effects were expected to be small the lack of power may not have affected the results, but we cannot be completely confident that HPV vaccination receipt does not negatively affect behaviour and attitudes. However, given that the effect sizes that were reported were so small it could be suggested that even if significant changes or differences did occur they would have been too small to be clinically meaningful and so not of concern on a population level.

The reduced sample size also affected the stability of the models. On a number of occasions models were run that were not the best fit to the data and included cases that it would have been optimal to remove had enough cases made all responses possible (for example some cells were empty meaning that models could not be run). The complex samples analysis used more sophisticated statistical methods than regular general linear models and logistic regression meaning that they were stricter in adhering to the assumptions necessary to perform the models. Had simpler statistical methods been used more of the models may have been possible to have been performed but this could have masked the fact that the data were not appropriate for these models. Because of the reduced sample size demographic characteristics were not included in the sexual behaviour models as the large number of categories meant that many cells were empty so analysis could not be run. Given a larger sample size it would be interesting to consider the effect of demographic characteristics.

Participants in the present studies were in post-compulsory (post-16) education and consequently were likely more academically qualified than other 16-18 year olds who are not in education. The most up-to-date figures show that 62.5% of 16-18 year old girls were in full-time education in England in 2007 (Office for National Statistics, 2008) suggesting that the findings of these studies should not be extrapolated to girls who are not in education (those who are working, unemployed or on government training schemes). The

participants recruited from the colleges were highly heterogeneous; the proportion of participants from ethnic minorities generally did not reflect the English average but were closer in characteristics to the London average. Most girls were not entitled to EMA suggesting that the samples were reasonably affluent. Finally the participants were all attending colleges located in the South East of England and London and girls from elsewhere in England were not investigated. As a result of these demographic deviations from the English average and based on the response rates that used the number of participants registered in the colleges the generalisability of these results must be considered when interpreting the findings of these studies.

The Cronbach's alphas for the communication about sex scale were not as high as desired and there was likely between 21% to 30% error in measurement. Caution should be taken regarding non-significant findings which may have been significant had measurement been more accurate. Kline (1999) asserted that an alpha of greater than .7 is appropriate when interpreting Cronbach's alphas for internal reliability, however, this does not take into account the number of items included in the scale. When there are fewer items in a scale, such as in the scale for the present studies, it is less likely that the alpha will be high regardless of the actual internal reliability (Grayson, 2004) and this may have been the case for the communication about sex scale.

In these studies sexual behaviour was measured by self-report. It was not possible to have an objective measure of sexual intercourse meaning that the chosen method of assessing sexual behaviour was not perfect due to the potential for inaccurate memory recall and social desirability bias. During data collection comments from the girls, particularly girls from Colleges 3, 7 and 8, made it apparent that girls from some cultures were not expected to have sex before marriage. For these girls to admit, even in an anonymous questionnaire, that they had reached sexual debut may be socially stigmatising and not worth their honesty in a questionnaire administered by a relative stranger who they have no reason to risk their reputation for. Even if abstinence before marriage is not encouraged, socially derived norms of girls being chaste are socially rewarding and impact on personal reputations (Marston & King, 2006). Consequently, girls may have been reluctant to be entirely honest

about their age of sexual debut or number of sexual partners. It is possible that the number of girls who had reached sexual debut was actually greater than the number who reported being sexually active, that the average age of sexual debut was younger than reported and that the average number of sexual partners was higher than reported. To further confuse this there is evidence that individuals who fail to respond to questions about sexual behaviour are less sexually experienced than non-responders which could mean that the average number of sexual partners was inflated (Fenton et al., 2001a). Unfortunately these are issues associated with the assessment of sensitive personal information and are applicable to research in other health domains (Wellings et al., 1990); however because of this uncertainty it may be more appropriate in the present studies to pay attention to the confidence intervals reported for significant effects rather than specific effect sizes.

Non-significant results reported in the present studies may have been due to such limitations in measurement of the dependent variables. However, all of the dependent variables had been used previously in published research, they showed high test-retest reliability as baseline and follow-up assessments were highly related and they were associated with factors that one would expect the dependent variable to be associated with (data not reported). For example, oral contraceptive use related to condom use and having ever had a boyfriend was associated with age of sexual debut.

The condom use analysis focused on heterosexual sexual risk behaviours and did not account for women who engage in sexual activities with other women. Analysis of the NATSAL survey conducted in 2000 estimated that 3.9% of 16-44 year old women from Greater London had a female sexual partner in the last five years and this was 2.4% of women for the rest of the UK (Johnson et al., 2001). The condom use analysis may not have been appropriate for a small proportion of the sample. It is possible that such participants would not have deemed the condom use question relevant to them and may have not responded to this question.

It could be argued that the follow-up period in the prospective study was not sufficient in duration for behaviour change to have been detected. However, a longer follow-up

duration would have increased the number of potential confounding variables affecting the likelihood that effects were due to HPV vaccination receipt only. Vaccinated girls are likely to have received their first dose of the HPV vaccine at least four months prior to follow-up assessment, giving girls who were already in relationships plenty of time to adapt their sexual behaviour and there was no evidence of behaviour change in the most at risk groups. It may not have been enough time for girls who were never sexually active to initiate a sexual relationship, however this reinforces the fact that there are other more influential factors than HPV vaccination in determining sexual activity.

Finally, the vaccinated cohort, were a self-selected group. Their decision to receive the vaccine may have been a result of inherent characteristics of this group that existed prior to vaccination. However, the study designs were as close as was possible to address aim four reliably. The study designs allowed for prospective observations as well as cross-sectional analysis. It would have been most desirable for the quasi cross-sectional study to have studied participants concurrently. However, as the HPV vaccination 'catch-up' programme was rolled out so quickly, it was not possible to study girls of the same age who had and had not been offered the vaccine at the same time. It was important to study girls of the same age to account for normal levels of sexual behaviour. The chosen study design for the quasi cross-sectional study was the closest possible that could reliability explore the impact of HPV immunisation on adolescents, accounting for the effect of the immunisation programme itself.

Conclusions

HPV vaccination receipt appeared to have no negative effect on the sexual behaviour of the 16-18 year old girls who took part in these studies. Vaccinated girls were no more likely to have inconsistent condom use or to have reached sexual debut than a pre-vaccination programme control cohort, or have an earlier sexual debut. Vaccinated girls did not use condoms more inconsistently after vaccination relative to girls who had opted not to receive the vaccine and vaccinated girls who were already engaging in risky sexual behaviours did not increase their number of sexual partners or use condoms any more inconsistently. This may go someway to alleviate parents' concerns about their daughters engaging in more

risky sexual behaviour following HPV vaccination. It is likely that girls who have participated in the HPV immunisation programme have acquired an appropriate understanding of their risk of cervical cancer and have adjusted their perceptions of risk accordingly. It appears that the information provided to girls in the UK immunisation programme is sufficiently informing them about the continued need for safe sexual behaviour and attendance at cervical cancer screening in the future. Immunisation programmes in other countries may benefit from adopting the educational literature used in the UK. Vaccinated girls' intentions to attend for cervical cancer screening in the future were more positive than the unvaccinated control cohort of girls and their intentions did not alter following vaccination relative to girls who opted not to receive the vaccine. Parents are missing out on the opportunity to use HPV vaccination as a chance to discuss issues surrounding sex and contraception with their daughters. The programme itself, rather than vaccination receipt, may be influencing girls' perceptions of risk. This study provided evidence for risk-reappraisal theory but failed to provide complete support for risk compensation theory. Recommendations for future analysis and best practise for measurement were made including the adoption of 'feelings of risk' for the measurement of perceived risk and the necessity of substantial sample sizes.

Chapter 8 - Discussion

The development of a vaccine to prevent infection with HPV types established to cause most cases of cervical cancer and the introduction of this vaccine into childhood immunisation schedules worldwide has prompted a proliferation of research into this area. Acceptability of HPV vaccination has been considered often and numerous factors have shown associations with parents' intentions to consent to HPV vaccination for a daughter, or whether they have actually consented for their daughter to receive the vaccine.

It was highlighted in the review of the literature in Chapter 2 that parents' concern about their daughters' sexual behaviour following HPV vaccination was one factor that consistently related to HPV vaccination acceptance and was novel to HPV vaccination, rather than all childhood vaccines. Mothers' concerns fell into two groups. Firstly they were apprehensive that girls will engage in more risky sexual behaviour following vaccination because they believe themselves to be at a reduced risk of catching an STI (Marlow et al., 2007a; Olshen et al., 2005). Secondly, some mothers worried that their consent to vaccination would implicitly confer *'carte blanche'* approval for sexual activity (Constantine & Jerman, 2007; Waller et al., 2006).

Previous experience had shown the media to be hugely influential regarding vaccination uptake (Hackett, 2008) and there was evidence that the HPV vaccination was already being discussed in the UK and international press. These discussions were not always in positive contexts and often contained inaccuracies (Anhang et al., 2004b; Greene & Davies, 2008).

Two American studies had shown no association between sexual behaviour and receipt of the vaccine, although neither study was designed to demonstrate behaviour change or causation of relationships (Conroy et al., 2009; Neubrand et al., 2009). Hypothetically, adolescents had reported that they might change their behaviour and misconceptions were held about the protection afforded by the vaccine (Brabin et al., 2010; Conroy et al., 2009; Mathur et al., 2010; Robbins et al., 2010).

These issues had not been explored in detail in the literature and this thesis aimed to investigate their different facets. Risk compensation theory appeared to be an appropriate model to use to explore behaviour change following vaccination. It was hoped that with a greater understanding of parents' concern about these issues and knowledge of whether sexual behaviour will likely alter following vaccination, parents' anxieties could be challenged, with the intention of reducing resistance to HPV vaccination associated with concern about sexual behaviour. Accordingly, the objective of this thesis was to explore parents' concerns about sexual behaviour in their daughters following HPV vaccination, in the context of the UK HPV immunisation programme and examine whether these concerns would likely be realised.

This objective was addressed in five studies. The first study attempted to establish the extent that the issue of risky sexual behaviour following HPV vaccination was being addressed in the UK national press, in order to clarify what arguments parents have been exposed to. The second study investigated the degree of concern that mothers have about their daughters' sexual behaviour following HPV vaccination and the third study explored adolescent girls' beliefs about the meanings that they would interpret from their parents consenting to them receiving the HPV vaccine. The final two studies investigated the impact of participating in the HPV immunisation programme by examining risk perceptions, sexual behaviour, communication about sex with parents and intentions to attend for cervical screening in the future in older adolescent girls who were offered HPV vaccination as part of the UK HPV immunisation 'catch up' programme.

SUMMARY OF FINDINGS

Four specific aims were set to help achieve the thesis objective. Aims one to three were taken in turn and addressed by the studies reported in Chapters 4, 5 and 6. Aim four was addressed by the two studies reported in Chapter 7.

Aim 1: To explore whether the issue of girls engaging in increased risky sexual behaviour following HPV vaccination is being addressed in the UK national press.

My first study reported in Chapter 4, was the first systematic longitudinal examination of media coverage of the HPV vaccine in the UK. I used an electronic database of newspaper articles to retrospectively search the most highly read daily and Sunday newspapers in the UK over five years to identify articles that had considered the HPV vaccine and risky sexual behaviour following HPV vaccination. These articles were analysed qualitatively using Framework Analysis and content analysis. I explored the debates that parents have been exposed to about risky sexual behaviour and the vaccine by considering categories arising in these discussions, the content of the text within each category, when the categories occurred, their context and frequency of occurrence. The qualitative analysis was subjective in nature, meaning that researcher bias could have affected the interpretation of the articles. However, a number of warranting techniques were employed to ensure that the analysis was appropriate.

Just under half of the articles that mentioned the HPV vaccine also referred to risky sexual behaviour following HPV vaccination and 92 articles were included in the qualitative analysis. Media coverage of the vaccine was found to have grown since the development of the HPV vaccine, and the issue of adolescents engaging in risky sexual behaviours following vaccination was a minor, but consistently discussed theme. An increase in media coverage about the HPV vaccine has also been reported in studies exploring news reporting in the USA (for example, Kelly et al., 2009) and other research has found risky sexual behaviour in relation to the HPV vaccine to be discussed to a similar extent in newspaper articles (for example, Abdelmutti & Hoffman-Goetz, 2009). Arguments proposing that sexual behaviour would change were usually covered briefly and when they were endorsed this was often based on the opinion of unspecified opposition groups. On a number of occasions, articles that included arguments proposing that the HPV vaccination will not impact on girls' sexual behaviour quoted scientists, but their use may have a less emotive appeal than the messages that used fear-based discourse that were put forward by those who opposed HPV vaccination.

Both sides of the argument were covered in the articles and this will have allowed parents the opportunity to form their own opinions. The opposing arguments were frequently cited within the same article and this was reflected in the fact that most articles were deemed neutral in tone. However, neutrality of reporting adhered to by journalists may not provide adequate perspective to parents about how serious the issue really is. Vaccination programme managers must remain aware of how they can use the media to influence public opinion and be prepared to ensure that anti-vaccination sentiments represented in the press are countered if they continue to be represented.

The articles allowed readers to hear about the experiences of others and provided them with normative beliefs. Most of the parents quoted in the articles said that they were not unduly concerned about adolescent risky sexual behaviour following vaccination and this may have reassured parents reading the articles. However, most of these particular articles were published in broadsheet newspapers, whose readers are more likely from higher social classes, meaning that only certain groups may have been exposed to such normative beliefs. This has the potential to further increase knowledge inequalities (Tichenor et al., 1970).

Most newspaper-reading parents will at some point have read about opposition towards vaccinating girls and to the idea that the HPV vaccine could encourage risky sexual behaviour and this may have affected their opinions and future vaccination decisions. It would be interesting to consider how this issue has been reported by the media since the introduction of the HPV vaccination into the childhood immunisation schedule.

Aim 2: To establish the degree of concern that parents feel about HPV vaccination and sexual behaviour.

My first study reported in Chapter 4 showed that parents have regularly been exposed to the argument that HPV vaccination will impact on adolescents' sexual behaviour and these articles had the potential to affect parents' personal concerns about the vaccine. It had been reported in the literature that some parents were apprehensive about vaccinating their daughters against HPV because of concern that girls will engage in more risky sexual behaviour following vaccination due to a false belief that they have a reduced risk of

catching an STI. A number of studies had shown such concern to be associated with intentions to allow a daughter to receive the HPV vaccine (for example, Marlow et al., 2007a; Ogilvie et al., 2007). However, such concerns had not been explored in detail and Study 2 addressed this gap. Using an existing dataset of 341 mothers of daughters recruited in a national survey, I explored participants' beliefs about sexual behaviour following HPV vaccination, whether such beliefs predicted vaccination acceptance for a daughter and what predicted the extent to which mothers were concerned about this issue.

Most mothers were willing to vaccinate their daughters against HPV, indicating, in accordance with previous studies that acceptance of the vaccine was likely to be high when it became available. These strong intentions to vaccinate have been reflected in high uptake of the HPV vaccine in 12-13 year old girls offered the vaccine as part of the UK childhood immunisation programme (Department of Health, 2010). However, some agreed that their daughter may have more sex, more unprotected sex, and would become more promiscuous after having the vaccine. Independently these beliefs were associated with willingness to accept the vaccine for a daughter, with mothers who agreed to a greater extent that sexual behaviour would change less willing to consent to HPV vaccination for their daughter. Risk perceptions were important when exploring mothers' beliefs about risky sexual behaviour following HPV vaccination, with mothers who believed that they were more at risk of cervical cancer less likely to believe that sexual behaviour would change. This was likely due to mothers attempting to avoid cognitive dissonance: in the present study mothers with a high perceived risk of cervical cancer were more willing to vaccinate their daughter and so may have been less likely to agree with the belief statements to avoid such psychological tension or mothers who were unwilling to vaccinate their daughters using concern about sexual behaviour as evidence to support their decision not to vaccinate. As a result, although beliefs about risky sexual behaviour appear associated with acceptance, addressing these beliefs with mothers may not be the most effective way to increase vaccination uptake.

In multi-variable tests, mothers' sexual behaviour beliefs were no longer related to willingness to consent to HPV vaccination when mothers' own perceived risk of cervical

cancer was included in the model. This finding contrasted with three published studies (Bernat et al., 2009; Dahlstrom et al., 2010; Ogilvie et al., 2010). It was possible that differences between these studies were due to lack of power in the present study and cultural differences (the three other studies were conducted outside of the UK). If the present study was correct in its findings the results were reassuring as although mothers may have believed that girls will engage in more risky sexual behaviour after vaccination, other factors were more strongly associated with their decision to consent to vaccination for a daughter. The effect of perceived risk appeared so strong that it overrode other factors that were also associated with vaccination decisions. Vaccination uptake may be improved by using framing to manipulate perceived risk in information materials or considering perceived risk when developing decision aids to support HPV vaccination decision making.

Aim 3: To establish girls' views on HPV vaccination and sexual behaviour

In addition to parents being apprehensive that girls will engage in more risky sexual behaviour following HPV vaccination, parents have also expressed concern that their consent to vaccination may be misinterpreted by girls as implicit approval for sexual activity. Similarly to the first parental concern about sexual behaviour investigated in my second study, reported in Chapter 5, this particular anxiety had not been considered in detail in the academic literature and my third study, reported in Chapter 6, sought to provide some initial insight into whether girls would equate parental consent to vaccination as consent to start having sex. Adolescent girls recruited in school completed a questionnaire asking them to respond to a series of statements about what parental consent to HPV vaccination would mean to them in terms of sexual behaviour and other issues relating to HPV vaccination. Their intentions to receive the vaccine were also assessed along with whether they believed their parents would provide consent to their receiving the vaccine.

Most girls expressed strong intentions to receive the vaccine and believed that their parents would consent. The majority would infer positive messages about vaccination and other HPV vaccination-related issues if their parents consented to vaccination with most girls believing that consent would mean that their parents wanted to protect them against

cervical cancer and STIs. Most girls did not believe that vaccination consent implied approval for them to be sexually active. Parents concerned about negative changes in sexual behaviour following vaccination may be reassured by this, and feel happier about consenting to their daughters having the vaccine. However, some girls believed that consent implied that they were old enough to have sex (8%), or that it was okay for them to be sexually active (10%) but these beliefs were not related to whether they believed their parents would provide consent. Of further concern was the finding that girls with strong intentions to receive the vaccine were more likely to perceive that parental consent to vaccination implies that the recipient is old enough to have sex. A range of misconceptions held by adolescents about the HPV vaccination have been reported in the literature and together with the findings of the study reported in Chapter 6, have implications for the future sexual behaviour of girls. It may be beneficial for some girls to talk to their parents or a healthcare professional about the HPV vaccine to address such misconceptions. However, the findings may have been due to the cross-sectional nature of the data; it may have been that girls who felt ready to have sex were more likely to intend to have the vaccine. Additionally, even if girls believe they have been given '*carte blanche*' to be sexually active, this does not mean that they will necessarily become sexually active.

Aim 4: To examine the effect of participation in the HPV immunisation programme on sexual behaviour in older girls participating in the 'catch-up' programme.

The conclusions drawn in Chapters 5 and 6 suggested that some parents show concern about their daughters' sexual behaviour following HPV vaccination and some girls would misinterpret their parents' consent to HPV vaccination as implicit approval for sexual activity. However, it had not been explored whether parents' concerns were valid and whether girls' confusions about HPV vaccination would result in negative behaviour change or negative changes in intentions. There was some evidence to suggest that cervical screening attendance may not be optimal in vaccinated girls and also that HPV vaccination may conveniently be used as a 'cue to action' for parents to talk with their daughters about sex. Two studies were reported in Chapter 7. The first was prospective in design tracking a cohort of girls recruited from eight further education colleges and sixth forms over six months. The second study was a quasi cross-sectional study comparing differences

between girls who had been not been offered the HPV vaccine and girls who had received at least one dose of the HPV vaccine. The two groups were recruited one-year apart. Separate analysis exploring risk perceptions was also performed. A number of the analyses were underpowered meaning that we must question the certainty of non-significant findings and were the research to be conducted again I would consider measuring some of the dependent variables differently (for example, provide more detailed definitions of sexual behaviour).

The quasi cross-sectional study found that vaccinated girls were no more likely to have reached sexual debut than unvaccinated girls, and did not differ from the pre-programme control cohort in terms of their age of sexual debut or condom use. The prospective study showed that vaccinated girls had not changed their condom use relative to girls who opted not to receive the vaccine and neither had vaccinated girls who were already inconsistently using condoms prior to vaccination. In girls who before vaccination had a greater than average number of sexual partners, vaccinated girls had also not increased their number of sexual partners relative to girls who opted not to receive the vaccine. Such findings are positive, suggesting that HPV vaccination has not negatively affected girls' sexual behaviour and may go some way to alleviate parents' concern about the impact of HPV vaccination on the sexual behaviour of their daughters.

The prospective study found that vaccinated girls lowered their perceived risk of cervical cancer to a greater extent than girls who opted not to receive the vaccine, but did not change their perceived risk of HPV infection or STIs. The quasi cross-sectional study showed that vaccinated girls had lower risk perceptions for cervical cancer, HPV and STIs than girls in the pre-programme control cohort. The lower risk perceptions for cervical cancer and HPV were appropriate and the findings for STI risk perceptions may have been due to inappropriate definitions being provided to participants or misconceptions held by vaccinated girls about what the vaccine provides protection from. The differences in findings between the two studies were likely due to exposure to the HPV immunisation programme. In the prospective study risk perceptions of HPV and cervical cancer (but not of STIs) predicted vaccination receipt suggesting that girls understood the reason that the

HPV vaccine is being given. The results provided partial support for risk-reappraisal theories in the context of HPV vaccination in that an intervention caused a change in perceived risk. There was also evidence for part of risk compensation theory as in the quasi cross-sectional study the vaccinated girls had lower perceptions of risk than the unvaccinated girls (Adams, 1985; Adams, 1988; Wilde, 1982) and partial support for behaviour-motivation theories as in the prospective study perceived risk predicted vaccination receipt. However, there was no evidence that these reductions/differences in perceived risk influenced subsequent behaviour, as behaviour-motivation and risk compensation theory would suggest. As a result there was also no evidence of original levels of actual risk being restored, in accordance with risk compensation theory (compensatory action taken to restore levels of risk back to desired levels). This finding suggested that although girls may have believed that they might change their behaviour, as reported by Brabin et al. (2009) and Gottvall et al. (2009), they have not actually done so.

Most girls did appear to have had conversations with their parents about sex previously, although HPV vaccination receipt was not being used by parents as an opportunity to discuss sex with their daughters. This may be to the detriment of some girls as children who do not talk to their parents about sex are at an increased risk of earlier sexual debut and of adopting STI-risk behaviours, such as having multiple partners and inconsistent condom use (Diiorio et al., 2003; Zimmer-Gembeck & Helfand, 2008). Educational interventions that already exist should be employed to help parents effectively use the three-dose vaccination schedule as an opportunity to discuss sex with their daughters and go some way to ensure that conversations about sex are a series of conversations rather than a one-off chat.

Reassuringly, in the prospective study vaccinated girls did not change their intentions to attend for cervical cancer screening in the future relative to girls who opted not to receive the vaccine, and in the quasi cross-sectional study they held more positive intentions than the control cohort. This was contrary to a previous study of Danish young women who reported that they did not think they would consistently attend for cervical cancer screening

in the future (Mortensen, 2010). It will be important to monitor whether the findings of the present study are reflected when these girls start being invited for screening.

Misconceptions about the vaccine reported in Chapter 6, apparent in Chapter 7 also and shown in previous research (for example, Mathur et al., 2010; Robbins et al., 2010), could have impacted on the sexual behaviour and intentions to attend for screening, but this appears not to be the case. Vaccination programme coordinators should ensure that HPV information materials continue to draw attention to the fact that the vaccine does not protect against other STIs and coordinators in countries outside of the UK should consider using the information materials given to girls as part of the UK immunisation programme as they appear effective.

Overview of findings

Before these studies were conducted we knew that mothers were concerned about the effect that HPV vaccination may have on girls' sexual behaviour and would not provide consent to vaccination for this reason. Mothers' concerns included apprehension about girls engaging in more risky sexual behaviour because of perceived protection from STIs and concern that their providing consent to vaccination implicitly conferred consent for sexual activity. The HPV vaccine had received coverage in the UK and international press and this coverage was not always positive or accurate. Research had not explored discussions of the HPV vaccination and sexual behaviour in the news media. Although research had yet to consider whether receipt of the HPV vaccination would impact on the sexual behaviour of adolescent girls, some girls had reported that they would change their behaviour and many held misconceptions about the protection afforded by the vaccine. Risk compensation theory was deemed unlikely to be applicable on a population level to HPV vaccination, but it was plausible that it would be relevant if certain conditions were fulfilled. Additionally it was considered an appropriate model to help investigate whether sexual behaviour would change.

The studies in this thesis continued to show that some mothers report concern about the impact of HPV vaccination on the sexual behaviour of their daughters, and these concerns

have been raised in the national press. The concerns have also been countered in the media and parents have had the opportunity to hear about positive normative beliefs reported by other parents regarding vaccination and sexual behaviour. Parents' concerns include worry about girls having more sex, more unprotected sex, and becoming more promiscuous after having the vaccine and they are apprehensive that girls will take vaccination consent to be equivalent to approval for sexual activity. However, these concerns appear not related to willingness to allow a daughter to receive the vaccine and mothers' own perceived susceptibility to cervical cancer appears more pertinent in mothers' decisions to allow girls to have the vaccine.

Parents' concerns about implicit messages interpreted from vaccination consent may have been appropriate to some extent as some adolescents would infer implicit consent to sexual activity were their parents to allow them to receive the vaccine. Girls would also take positive messages about HPV-vaccine related issues however and the extent that the girls thought their parents would be concerned about their sexual behaviour following HPV vaccination was not related to whether girls thought their parents would provide consent to vaccination.

In reality the information materials and education accompanying the HPV immunisation programme appears to be informing girls sufficiently to ensure that sexual behaviour and cervical screening intentions do not become more negative following HPV vaccination, even though perceptions of risk have lowered following vaccination compared with those who did not take up the offer of vaccination. Vaccinated girls have not started using condoms more inconsistently relative to girls who opted not to receive the vaccine. These findings were also true of girls who were at most risk of changing their behaviour and these girls have also not increased their number of sexual partners. Vaccinated girls have not had an earlier sexual debut, do not use condoms any less consistently than a pre-programme control cohort of girls and are no more likely to have reached sexual debut. Parents' concerns about sexual behaviour following HPV vaccination may have resulted in them being reluctant to discuss sex with their daughters in the context of HPV vaccination so that implicit messages of approval for sexual activity are not conveyed.

STRENGTHS AND LIMITATIONS

As the two studies reported in Chapter 7 found no change in behaviour and found no difference between vaccinated and unvaccinated girls, it is important to critique the study methodologies to consider whether null findings were the result of poor study design. This is especially important considering that this issue was deemed worthy of attention academically and publicly when this thesis was initiated. In a similar vein, the rational for the final two studies was based in part on the findings of the studies reported in Chapters 4, 5 and 6. This rational may have been inappropriate if these previous studies had inadequate methodologies. Accordingly, the strengths and limitations of this thesis are discussed below.

Participants

The choice of participants and where they were recruited from will likely have influenced the results reported in this thesis. Accordingly it is important that the samples are representative of the populations that the findings will be extrapolated to. It is likely that the participants recruited for the studies in Chapters 5, 6 and 7 may not have been wholly representative of the general British population, meaning that the results may not be generalisable beyond the specific populations that were studied.

In the study reported in Chapter 5, only just over half of participants who were approached agreed to participate. Research suggests that non-responders are more likely to have a lower SES, be older, male and less engaged with the topic under investigation (Porter & Whitcomb, 2005), meaning that the attitudes of these groups will less likely have been included in the analysis (excluding males). Extensive measures were in place to maximise response rates for this study, including providing incentives and attempting to contact the address at least four times (including one weekday evening and weekend). Despite this 33% of individuals who were contactable refused to participate. Were the study to be conducted again it may be useful to use additional methods to improve response rates such as entering responders into a prize draw. However, the strength of the sample was enhanced by participants being recruited nationally and using random probability sampling.

The findings in Chapter 6 were based solely on the responses of girls recruited from one secondary school in the South East of England whose students were less likely than the national average to be entitled to free school meals (a means tested benefit). It will be important to replicate this study in a larger, more heterogeneous sample. Participants must be recruited from more economically diverse schools, which could be identified using census area-level data (assuming the girls attend schools that are near to where they live) and recruited from across the UK, although this would make such research more expensive to run.

The participants in the studies reported in Chapter 7 were recruited from eight sixth form and further education colleges and the refusal rates were low, however the final samples did not include 16-18 year olds who were not in full-time education, were more ethnically diverse than the English average and were reasonably affluent. Girls who are unemployed, on government training schemes or who are in employment are all equally entitled to receive the HPV vaccine, but it is likely that their experience of vaccination will differ from those who are in education, especially in primary care trusts where the vaccine is provided in schools to those in education. For girls who are employed it may be more difficult for them to take time off work to visit their GP and girls who are unemployed may equally have competing priorities that are barriers to vaccination.

The response rate for the number of girls present in each testing session was very high. The questionnaires were completed during tutorial sessions. Attendance at these sessions is mandatory (and essential if the student is to qualify for EMA) but the sessions are not vital to ensure that students pass their subject exams. Participants attending the tutorial sessions are likely to represent the more motivated and conscientious students. It will be beneficial for future research to make efforts to recruit populations that are representative of the British population to ensure that the results are meaningful and useful.

Study design

In addition to the participants used in research, the design of the study is integral to its findings and inappropriate study design can cause misleading results. Cross sectional data

were used for the studies in Chapters 5 and 6 meaning that inferences could not be made about causation. However, a strength of the first study reported in Chapter 7 was its prospective design that allowed for more definitive conclusions to be drawn about the results. The quasi cross-sectional study reported in Chapter 7 recruited a de facto control group which allowed for normal levels of sexual behaviour to be controlled for. This type of work is time consuming; however, the increasing certainty of the results is highly valued when such research is uncommon. A mixture of qualitative and quantitative research has been reported in this thesis. This triangulation of methods will have increased the validity of the general findings and conclusions.

Power

It is essential that studies are sufficiently powered to detect significant effects and, in accordance with convention, 80% power was deemed an appropriate level in this thesis. The studies reported in Chapters 5, 6 and 7 were not powered to detect small effect sizes (smaller than r=.16 for Chapter 5, smaller than r=.22 for Chapter 6 and smaller than r=.16 for Chapter 7). Effect sizes were reported that were smaller than this in all of these studies, meaning that non-significant findings that were coupled with small effect sizes should be treated with caution as they may not have been powered sufficiently. However, given that these effect sizes were so small, they would likely have been too small to be clinically meaningful and effectively non-significant on a population level.

Theoretical approach

A key strength of this thesis is the use of theory to explore issues that were lacking in evidence. The two studies in Chapter 7 were only the second application of risk-compensation theory to an inherently health-related context. They improved upon previous limited assessments of risk-compensation theory by measuring risk perceptions directly, which would have allowed more definitive conclusions about the cause of changes in behaviour were they to have been present.

Social cognition models of health psychology proved a useful structure to focus a review of vaccination refusal in Chapter 2 and numerous concepts were deemed influential. The

factors identified as being influential in vaccination refusal fitted neatly within social cognition models of health psychology, highlighting the importance of theory in study design and interpretation. Although multi-variable findings were not considered in the review, social cognition models of health psychology detailed the pathways through which the univariate findings could be influencing vaccination refusal and allowed a model of vaccination refusal to be outlined. Criticism has been directed at HPV vaccination research for its lack of theory in study design (Zimet et al., 2006) and this thesis will help go towards a stronger body of HPV vaccination literature.

Focus on females

HPV vaccination has been criticised for continuing to place the responsibility for sexual health with females. Not only are girls the focus of HPV vaccination programmes worldwide, but discussions about including males in these programmes talk about the protection that their inclusion would provide to females, in addition to the limited oncological protection provided to boys themselves (Thompson, 2010). It was identified in Chapter 2 that fathers only have not been the focus of any research exploring vaccination receipt. Mothers may traditionally be the primary caregiver for children and so have been most likely to have brought their child to clinics for vaccination, where recruitment for studies often occurred. However, these studies have neglected that fathers will likely be involved in the vaccination decision making process and their opinions need considering. This thesis has further contributed to this bias in sexual healthcare. Mothers, and not fathers were studied in Chapter 5, and girls only were considered in Chapters 6 and 7. Given that research in this area was limited when this PhD was initiated, it was appropriate for preliminary research to consider populations who were going to most proximally be affected by the programme. However, future research must explore the attitudes of fathers, and the attitudes of boys who are likely to have sexual relationships with vaccinated females at some point.

Confounding factors

Like all research that is conducted with ‘real people’ in the ‘real world’ the studies conducted for this thesis were not unaffected by current affairs that impacted on

participants and the pertinence of certain issues. When this PhD was instigated, concern about sexual behaviour following vaccination was considered an important issue that was going to have to be addressed for the vaccination programme to be successful. However, as the programme was implemented, current affairs demanded that other issues became more of a concern. As described in Chapter 1, a television personality who was popular with young women, died from cervical cancer in 2009 and a Coventry school girl also died that year after she had received the HPV vaccine (although it was later confirmed that her death was not related to her vaccination receipt). Both of these events occurred whilst the studies reported in Chapter 7 were ongoing and will likely have both raised awareness of cervical cancer and its severity and increased concern about HPV vaccination. The fact that issues regarding sexual behaviour became less pressing does not make the research presented in this thesis any less important. The findings will be relevant when other STI vaccines are introduced and this thesis has highlighted that such issues are relevant to a significant minority of individuals who are affected by HPV vaccination.

Other protection afforded by HPV vaccination

In addition to cervical cancer, HPV types covered by the bivalent and quadrivalent vaccines are established to cause genital warts, cancer of the anus and some penis and oral cancers (Palefsky, 2006; Palefsky, 2010). This thesis considered only the protection offered by HPV vaccination against cervical cancer as this is the focus of the UK HPV immunisation programme and the vaccine providing protection against genital warts is not offered free at the point of receipt to British girls. It is likely that parents would show greater concern about vaccinating their daughters against an STI were the quadrivalent vaccine offered to girls in the UK because of its more immediate focus on a widely recognised STI, genital warts. If the quadrivalent vaccine was offered in the UK or either vaccine made available for males, it will be important to understand parents' attitudes towards vaccinating against these diseases and infections.

Research and researcher effects

It is possible that participants in the present study were affected by participation in the research, and this may have affected the results. Given the novelty of the HPV vaccine,

respondents in the studies reported in Chapter 5 and 6 particularly may not have considered the HPV vaccine in detail previously. The discussion of risk and the information provided to the participants may have been a cue to action for mothers to increase their concern about HPV vaccination and sexual behaviour or for girls to become more cautious about their sexual behaviour. The results may have been the consequence of a first reaction to the information, rather than a deliberated response which will likely happen when parents and girls are actually making decisions about whether to accept the HPV vaccine. Alternatively, the results may have been due to the participants reflecting more over the information than they would for a routine vaccine. It may be useful to repeat these studies now that the HPV immunisation programme is underway and awareness is likely higher than when the studies were first conducted (2007 and 2008).

In a similar vein, the researcher may have affected the results herself. As is the case with all qualitative analysis, the qualitative analysis of newspaper articles in Chapter 4 was subjective and is likely to have been influenced by my pre-existing perceptions about particular newspapers or opinions about the HPV vaccination.

Reliability and validity of measures

The reliability and validity of the measures used will impact on the findings of research. It is important that the measures used ensure that the results would be reproducible and consistent if the study were conducted a number of times. I calculated Cronbach's alphas for all of the scales used in the studies reported in Chapter 7 so that the reliability of the measures was transparent. All scales had at least a good reliability estimate. Two constructs of perceived risk were measured in these studies to ensure that the most appropriate measurement tool was employed.

Vaccination receipt was determined by self-report which could be subject to bias. However, respondents had no obvious reason to deceive the researchers about their vaccination receipt and vaccination receipt would have been within the previous six months so was unlikely to have been subject to recall bias. Furthermore, objective measures of

immunisation receipt have been shown to be imperfect (Harrington et al., 1995; Jefferies et al., 1991; Salmon et al., 2005; Wei et al., 2009).

If an item does not measure what it is designed to measure, conclusions that are drawn about the results are likely to be inappropriate. One could question whether the measures used to assess the girls' beliefs about the meaning behind their parents' consent to HPV vaccination in Chapter 6 were valid. Although these measures were developed based on existing literature, were piloted and participants were given an example question prior to completing the items, the questions were complex and the girls may have been confused by them. In Chapter 6 it was suggested that future research should consider girls' beliefs about the meaning behind their parents' vaccination consent in varying contexts, using alternative methodologies and for the study to be repeated.

Inconsistent condom use was defined in these studies as a risky sexual behaviour, however this did not acknowledge the possibility that some participants may have been in sexual relationships where condoms were not essential to reduce risk of STI transmission or pregnancy (participants may have been using an oral contraceptive in a relationship in which both individuals were virgins or had both received negative STI screening results). In these circumstances reporting that condoms were never used during sexual intercourse would not have been a risky behaviour. Oral contraceptive use[22] was adjusted for in the final condom use models and this adjustment did not cause vaccination to become associated with condom use in the prospective study and stopped any associations in the quasi cross-sectional study.

Finally, in Chapter 7, there may have been variation in the girls' interpretation of 'sexual intercourse'. Although it was stated in the questionnaire that sexual intercourse was defined as 'vaginal sex', anecdotal conversations with girls during data collection highlighted that the girls' definitions of what 'counted' as sexual intercourse differed. For

[22] In 2008/2009 in Great Britain oral contraceptives were the second most common contraceptive method used by 16-19 year old women after male condoms (Office for National Statistics, 2009).

example, for a number of girls it was the event of male ejaculation that signified sexual intercourse rather than the act of vaginal intercourse itself. Similar issues were reported in the NATSAL survey (Wellings et al., 1990). This has implications for safe sex as girls may feel that some acts of intercourse do not require a condom and may also have impacted on how the girls responded to the question about their frequency of condom use during intercourse.

IMPLICATIONS OF FINDINGS

Implications for theory

As a whole, the results presented in this thesis have implications for theory in health psychology. Constructs from the health belief model, protection-motivation theory and theory of planned behaviour were all shown related to vaccination refusal in the review of the literature in Chapter 2, particularly barriers/benefits, normative beliefs and perceived susceptibility. Throughout this thesis, perceptions of risk were shown important in the context of HPV vaccine acceptability and when considering HPV vaccination receipt. It is essential that theories that acknowledge the importance of perceived vulnerability are applied to future research in this context.

The combined results of the studies reported in Chapter 7 only provided support for some of the pathways highlighted in risk-compensation theory, suggesting that it is not relevant to HPV vaccination. The theory did provide a useful framework with which to investigate behaviour change. There was also some evidence for behaviour-motivation theories as perceptions of risk predicted vaccination receipt, suggesting that behaviour-motivation may be evident following HPV vaccination. There was evidence for risk-reappraisal theory as vaccination did cause risk perceptions to change. These findings help contribute to the body of evidence supporting/opposing these theories and will assist in the modification of these theories.

In accordance with Weinstein et al. (2007) ‘feelings of risk’ was deemed a better predictor of behaviour than ‘perceived likelihood’. None of the ‘perceived likelihood’ variables were

related to vaccination receipt whereas 'feelings of risk' for HPV was associated and 'feelings of risk' for cervical cancer showed a similar trend. This finding can help strengthen the literature considering the measurement of perceived risk. It is essential that measurement tools reduce error and the resulting bias as much as possible; using 'feelings of risk' may be the appropriate way to do this when investigating HPV risk perceptions and subsequent preventive behaviour related to those perceptions.

Implications for policy and practice

The findings of this thesis will also impact on HPV vaccination and cervical cancer screening policy and practice. Reassuringly girls do not appear to be changing their behaviour following HPV vaccination and it appears that current information materials provided to girls when they are offered the vaccine are sufficient to ensure that this continues to be the case. Misconceptions held by girls before they have been invited for vaccination (identified in Chapter 6 and Chapter 7) could be addressed earlier than they are presently (when girls are first offered the vaccine), for example as part of personal, social and health education classes to ensure that beliefs do not have time to become ingrained and more difficult to change. Nurses administering the vaccine need to be aware of how to address adolescents' misconceptions about the vaccine, and training must be provided to ensure that nurses are equipped with the skills to do so. Although parents will likely feel reassured by the findings of the two studies reported in Chapter 7, any concerns that they continue to have could further be addressed by ensuring that adolescent girls are fully informed about the vaccine early on. School nurses may also be appropriate individuals to engage with parents who are reluctant to consent to vaccination and they must also feel they have the necessary knowledge to do so. It may be appropriate for perceived risk to be raised, as mothers with a high perceived risk of cervical cancer held more positive intentions to vaccinate their daughters in spite of negative beliefs about sexual behaviour following HPV vaccination. However, providing mothers with the true likelihood of cervical cancer may also reduce risk perceptions due to the rarity of the disease. Vaccination programme coordinators in countries outside of the UK, who have also decided to used the bivalent vaccine, may benefit from adopting the information materials provided as part of the UK immunisation programme as they have shown successful.

Vaccination programme coordinators in the UK and their press offices need to remain aware of the influence the media has in affecting parents' vaccination decisions as has been evident with the MMR vaccine and has the potential to occur with HPV vaccination. They must be prepared to counter negative arguments that have shown to be present in the UK press. The main finding of the studies reported in Chapter 7, that HPV vaccination does not negatively affect the sexual behaviour of girls, would be an ideal 'positive' story that could be disseminated to parents via the media.

Despite high intentions to attend for cervical screening in the future reported in the two studies in Chapter 7 and vaccinated girls being more likely to intend to attend for cervical cancer screening than those not yet involved in the programme, it will be important to ensure that information materials that accompany screening invitations are adapted to highlight the necessity of screening despite HPV vaccination receipt, as this is not the case with the information materials currently provided (NHS Cancer Screening Programmes, 2010). It will be especially important to ensure that vaccinated girls' intentions to attend for cervical screening are acted upon when they are first invited for screening, as 25-29 year olds in England are the least likely age group to attend (The Information Centre, 2010b).

FUTURE RESEARCH

Monitoring of cervical screening attendance in vaccinated populations

Cervical cancer screening recommendations are unlikely to be adapted for girls who receive the HPV vaccine as part of the 'catch-up' programme, but updated screening intervals will likely be developed for girls receiving HPV vaccines as part of the main programme (Franceschi, 2009). Cervical cancer screening in some form will still be necessary for all vaccine recipients as current HPV vaccines provide protection against HPV types that cause 70% of cervical cancers. Furthermore, because HPV vaccination will reduce the number of abnormal cytology results, cytologists may find it increasingly difficult to maintain the concentration needed to spot abnormal cell changes (Franceschi, 2009). With the increased likelihood of false negatives, regular screening may be even more important. The two

studies reported in Chapter 7 showed that girls' intentions to attend for cervical cancer screening in the future were not affected by HPV vaccination, however, it will be important to monitor screening attendance to ensure that vaccinated women do continue to be screened. In England, the oldest girls in the catch-up group will not be invited for screening until 2015 when the girls will be 25 years old. All other countries in the UK start screening at age 20 so it will be important to consider the attendance of these girls from September 2010 onwards.

Future HPV and STI vaccines

Second generation HPV vaccines are in development and have the potential to improve HPV vaccination delivery in developing countries, reduce the burden on recipients in terms of the vaccination schedule, reduce cost and inconvenience (Franceschi, 2009). Efforts are being made in developing lyophilised (freeze dried) vaccine preparations, which would reduce the need for a cold chain and make vaccination in developing countries increasingly more feasible. Mucosal delivery approaches via a nebuliser have shown similar antibody responses to those delivered by intramuscular injection (Nardelli-Haefliger et al., 2005) and would reduce resistance to vaccination due to fear of needles. Girls in both developing and developed countries may be helped by the manufacturing of single dose HPV vaccines that would mean reductions in cost (currently the HPV vaccine retails at around $125 per dose, $375 for the full series, Centers for disease control, 2010). The reduction in doses would mean fewer opportunities for HPV vaccination to be used as a 'cue to action' for related educational interventions. The current schedule creates a six month period in which girls can be educated about HPV vaccination, the importance of screening and related sex education which one-off vaccination would not allow. It will be important to ensure that if HPV vaccination is to be used as a 'cue to action' that interventions are concise and appropriate to be delivered alongside a single vaccination event.

The development of HPV vaccines that provide protection from other oncogenic HPV types is underway and the manufacturers of Gardasil® are currently trialling a nine virus-like particle HPV vaccine. Girls receiving multivalent vaccinations will likely have even greater reduction in perceived risk of cervical cancer than were seen in the prospective

study reported in Chapter 7. Vaccines that are seen to offer more protection further have the potential to create misunderstanding about the protection afforded by HPV vaccinations, although as Chapter 7 showed this will likely be resolved through education. The potential for such confusions should be explored. Parents are likely to be wary of vaccines that afford protection from multiple virus types due to an existing fear seen in some parents of combination vaccines; a fear that was further amplified by the MMR vaccine controversy when Andrew Wakefield claimed that they overload children's immune systems (Offit, 2008). Alternatively, people may construct HPV vaccination as a single entity. It will be important to assess parental attitudes to the acceptability of these second generation HPV vaccines to ensure that appropriate steps are taken to maintain high uptake in the UK.

In addition to hepatitis B and HPV vaccination which are already available, a number of vaccines are in development to prevent other STIs, for example chlamydia, gonorrhoea, genital herpes and HIV. A small minority of parents have shown concern about vaccinating their daughters against HPV because of its sexually transmitted nature, even though, in the UK at least, it is being marketed as a vaccine against cervical cancer. It is likely that parents will show greater concern about vaccinating their children against infections that are recognised as sexually transmitted. Some effort has already been put into understanding the acceptability of STI vaccines and parents have been the focus of some of this research (Mays et al., 2004; Zimet et al., 1997; Zimet et al., 2005; Zimet et al., 2007). On the whole this research has been conducted with American parents and has been unable to investigate the attitudes of parents who are actually in the process of deciding whether to vaccinate a child with an STI vaccine as the vaccines are still only in development. Once these vaccines become available parental attitudes must be explored. Furthermore, it will be important to monitor the sexual behaviour of STI vaccine recipients, as is currently the case in HIV vaccine trials, to ensure that the protection afforded by these vaccines is not negated by an increase in risky sexual behaviour.

Use of theory in research exploring vaccination refusal

The review in Chapter 2 found that certain constructs considered important in social cognition models of health psychology have been understudied, which has resulted in there being insufficient evidence for their role in vaccination receipt, even though social cognition models would assert that they are likely to be influential, for example, self-efficacy from protection-motivation theory (Rogers, 1975; 1983) and the closely associated construct of perceived behavioural control from the theory of planned behaviour (Ajzen, 1985; Ajzen, 1988; Ajzen, 1991). It will be important to ensure that future vaccination refusal research is grounded in theory and that the theory is applied correctly and completely, as current research may be missing important findings that could be applied to interventions to improve vaccination uptake.

FINAL REMARKS

The development and introduction of a vaccine that protects against a sexually transmitted infection associated with cervical cancer has caused some parents to express concern about the impact that this vaccine may have on the sexual behaviour of their daughters and these concerns have been reported and also countered in the national press. A minority of parents have expressed concern about girls having more sex, more unprotected sex, and becoming more promiscuous after having the vaccine and other research has shown parents to be concerned that girls will take vaccination consent to be equivalent to approval for sexual activity. Some girls would believe HPV vaccination consent to give them carte blanche for sexual activity, but girls would also take positive messages about HPV-vaccine related issues. Parents' concerns do not appear great enough for mothers to refuse HPV vaccination for their daughters and girls believe that this will be the case also. In reality though, the introduction of HPV vaccination into the childhood immunisation schedule in the UK has not affected girls' sexual behaviour or cervical screening intentions, even though perceptions of risk of cervical cancer have lowered and this is likely in part due to the information materials and education efforts that have accompanied the programme. Parents' concerns about sexual behaviour following HPV vaccination may have resulted in parents being reluctant to discuss sex with their daughters in the context of HPV vaccination so that implicit approval of sexual activity is not conveyed. Risk perceptions are pertinent in HPV vaccination acceptability and when exploring changes in behaviour

following vaccination receipt. This thesis tells a ‘good news’ story and may go someway to alleviate the concerns of a minority of parents who are anxious about girls’ sexual behaviour following HPV vaccination.

References

Abdelmutti, N. & Hoffman-Goetz, L. (2009). Risk messages about HPV, cervical cancer, and the HPV vaccine Gardasil: A content analysis of Canadian and U.S. national newspaper articles. *Women and Health, 49,* 422-440.

Abraham, C. & Sheeran, P. (2005). The Health Belief Model. In M.Conner & P. Norman (Eds.), *Predicting Health Behaviour* (2 ed., pp. 28-80). Maidenhead: Open University Press.

Ache, K. A. & Wallace, L. S. (2008). Human papillomavirus vaccination coverage on YouTube. *American Journal of Preventive Medicine, 53,* 389-392.

Adams, J. (2000). *Risk*. (5 ed.) London: University College London Press Limited.

Adams, J. G. U. (1985). *Risk and freedom: the record of road safety regulation*. London: Transport Publishing Projects.

Adams, J. G. U. (1988). Evaluating the effectiveness of road safety measures. *Traffic engineering and control, June,* 334-352.

Agot, K., Kiarie, J. N., Nguyen, H. Q., Odhiambo, J. O., Onyango, T. M., & Weiss, N. S. (2007). Male circumcision in Siaya and Bondo districts, Kenya: Prospective cohort study to assess behavioral disinhibition following circumcision. *Journal of Acquired Immune Deficiency Syndromes, 44,* 66-70.

Ajzen, I. (1985). From intentions to action: a theory of planned behaviour. In J.Kuhl & J. Beckman (Eds.), *Action Control: From Cognitions to Behaviors* (pp. 11-39). New York: Springer.

Ajzen, I. (1988). *Attitudes, Personality and Behavior*. Milton Keynes: Open University Press.

Ajzen, I. (1991). The Theory of Planned Behavior. *Organizational Behavior and Human Decision Processes, 50,* 179-211.

Ajzen, I. & Fishbein, M. (1980). *Understanding Attitudes and Predicting Social Behavior*. Englewood Cliffs, NJ: Prentice-Hall.

Allen, J. D., Coronado, G. D., Williams, R. S., Glenn, B., Escoffery, C., Fernandez, M. et al. (2010). A systematic review of measures used in studies of human papillomavirus (HPV) vaccine acceptability. *Vaccine, 28,* 4027-4037.

Anhang, R., Stryker, J. E., Wright, T. C., & Goldie, S. J. (2004a). News media coverage of human papillomavirus. *Cancer, 100,* 308-314.

Anhang, R., Wright, T. C., Smock, L., & Goldie, S. J. (2004b). Women's desired information about human papillomavirus. *Cancer, 100,* 315-320.

Appleby, P., Beral, V., Berrington de Gonzalez, A., Colin, D., Franceschi, S., Goodill, A. et al. (2006). Carcinoma of the cervix and tobacco smoking: collaborative reanalysis of individual data on

13,541 women with carcinoma of the cervix and 23,017 women without carcinoma of the cervix from 23 epidemiological studies. *International Journal of Cancer, 1181,* 1481-1495.

Armitage, C. J. & Conner, M. (2001). Efficacy of the Theory of Planned Behaviour: a meta-analytic review. *Br J Soc.Psychol, 40,* 471-499.

Armitage, C. & Conner, M. (1999). Predictive validity of the theory of planned behaviour: The role of questionnaire format and social desirability. *Journal of community & applied social psychology, 9,* 261-272.

Askelson, N. M., Campo, S., Smith, S., Lowe, J. B., Dennis, L. K., & Andsager, J. (2010). The birds, the bees and the HPVs: What drives mothers' intentions to use the HPV vaccination as a chance to talk about sex? *Journal of Pediatric Health Care, In Press.*

Atkins, D., Best, D., Shapiro, E. N., & US Preventive Services Task Force (2001). The third U.S. Preventive Services Task Force: background, methods and first recommendations. *American Journal of Preventive Medicine, 20,* 1-108.

Atkins, D., Eccles, M., Flottorp, S., Guyatt, G. H., Henry, D., Hill, S. et al. (2004). Systems for grading the quality of evidence and the strength of recommendations I: critical appraisal of existing approaches The GRADE Working Group. *BMC Health Services Research, 4,* 38.

Auvert, B., Taljaard, D., Largarde, E., Sobngwi-Tambekou, J., Sitta, R., & Puren, A. (2005). Randomized, controlled intervention trial of male circumcision for reduction of HIV infection risk: The ANRS 1265 trial. *Public Library of Science Medicine, 2,* 1112-1122.

Bagozzi, R. P. (1992). The self-regulation of attitudes, intentions, and behavior. *Social Psychology Quarterly, 55,* 178-204.

Bailey, R. C., Moses, S., Parker, C. B., Agot, K., Maclean, I., Krieger, J. N. et al. (2007). Male circumcision for HIV prevention in young men in Kisumu, Kenya: A randomised controlled trial. *The Lancet, 369,* 643-656.

Bair, R. M., Mays, R. A., Sturm, L. A., & Zimet, G. D. (2008). Acceptability of the human papillomavirus vaccine among Latina mothers. *Journal of Pediatric and Adolescent Gynecology, 21,* 329-334.

Ball, C., Sackett, D., Phillips, B., Straus, S., Haynes, B., & Oxford Centre for Evidence-Based Medicine (2009). Levels of evidence and grades of recommendations. http://www.cebm.net/levels_of_evidence.asp [On-line].

Bandura, A. (1982). Self-efficacy mechanism in human agency. *American Psychologist, 37,* 122-147.

Barnack, J. L., Reddy, D. M., & Swain, C. (2001). Predictors of parents' willingness to vaccinate for human papillomavirus and physicians' intentions to recommend the vaccine. *Women's Health Issues, 20,* 28-34.

Barnard, A. (2009). The effects of taxes and benefits on household income, 2007/08. *Economic and Labour Market Review, 3,* 56-66.

Bartholow, B. N., Buchbinder, S., Celum, C., Goli, V., Koblin, B., Para, M. et al. (2005). HIV sexual risk behavior over 36 months of follow-up in the world's first HIV vaccine efficacy trial. *Journal of Acquired Immune Deficiency Syndrome, 39,* 90-101.

Becker, M. H. (1974). The health belief model and personal health behavior. *Health Education Monographs, 2,* 324-508.

Becker, M. H., Maiman, L. A., Kirscht, J. P., Haefner, D. P., & Drachman, R. H. (1977). The Health Belief Model and prediction of dietary compliance: a field experiment. *Journal of Health and Social Behavior, 18,* 348-366.

Benin, A. L., Wu, A. C., Holmboe, E. S., Shapiro, E. D., & Anyan, W. (2010). How can we communicate about vaccines with adolescents and their parents? *Clinical Pediatrics, 49,* 373-380.

Bentler, P. M. & Speckart, G. (1979). Models of attitude-behavior telations. *Psychological Review, 86,* 452-464.

Bernat, D. H., Harpin, S. B., Eisenberg, M. E., Bearinger, L. H., & Resnick, M. D. (2009). Parental Support for the Human Papillomavirus Vaccine. *Journal of Adolescent Health, 45,* 525-527.

Bhave, G., Lindan, C. P., Hudes, E. S., Desai, S., Wagle, U., Tripathi, S. P. et al. (1995). Impact of an intervention on HIV, sexually-transmitted diseases, and condom use among sex workers in Bombay, India. *AIDS, 9,* S21-S30.

Bish, A. (2000). Predicting uptake of a routine cervical smear test: A comparison of the health belief model and the theory of planned behaviour
PSYCHOLOGY & HEALTH. *Psychology & health, 15,* 35-50.

Black, W. C., Nease, R. F., & Tosteson, A. N. A. (1995). Perceptions of breast cancer risk and screening effectiveness in women younger than 50 years of age. *Journal of the National Cancer Institute, 87,* 720-731.

Blinn-Pike, L. (1999). Why abstinent adolescents report they have not had sex: Understanding sexually resilient youth. *Family relations, 48,* 295-301.

Boer, H. & Seydel, E. R. (1995). Protection Motivation Theory. In M.Conner & C. Norman (Eds.), *Predicting Health Behaviour* (1 ed., pp. 95-120). Buckingham: Open University Press.

Bond, G. G., Aiken, L. S., & Somerville, S. C. (1992). The health belief model and adolescents with insulin-dependent diabetes mellitus. *Health Psychology, 11,* 190-198.

Bosch, F. X., Castellsague, X., Munoz, N., deSanjose, S., Ghaffari, A. M., Gonzalez, L. C. et al. (1996). Male sexual behavior and human papillomavirus DNA: Key risk factors for cervical cancer in Spain. *Journal of the National Cancer Institute, 88,* 1060-1067.

Bosch, F. X. & de Sanjose, S. (2003). Chapter 1: Human papillomavirus and cervical cancer - burden and assessment of causality. *Journal of the National Cancer Institute Monographs,* 3-13.

Brabin, L., Roberts, S. A., Farzaneh, F., & Kitchener, H. C. (2006). Future acceptance of adolescent human papillomavirus vaccination: A survey of parental attitudes. *Vaccine, 24,* 3087-3094.

Brabin, L., Roberts, S. A., & Kitchener, H. C. (2007). A semi-qualitative study of attitudes to vaccinating adolescents against human papillomavirus without parental consent. *BioMed Central: Public Health, 7*.

Brabin, L., Roberts, S. A., Stretch, R., Baxter, D., Chambers, G., Kitchener, H. C. et al. (2008). Uptake of first two doses of human papillomavirus vaccine by adolescent schoolgirls in Manchester: Prospective cohort study. *British Medical Journal, 336,* 1058.

Brabin, L., Roberts, S. A., Stretch, R., Baxter, D., Elton, P., Kitchener, H. et al. (2009). A survey of adolescent experiences of human papillomavirus vaccination in the Manchester study. *British Journal of Cancer*.

Brabin, L., Stretch, R., Roberts, S. A., Elton, P., Baxter, D., & McCann, R. (2010). Survey of girls' recall of a film providing information on human papillomavirus and cervical cancer 6 months after an offer of vaccination. *Vaccine, 28,* 4210-4214.

Breitkopf, C. R., Pearson, H. C., Dinh, T. A., Tran, B. C. T., Vu, T., Phan, G. A. B. et al. (2009). Human papillomavirus vaccine decision-making in Da Nang, Vietnam: Perceived spousal and adolescent-parent concordance. *Vaccine, 27,* 2367-2371.

Brewer, N. T., Chapman, G. B., Gibbons, F. X., Gerrard, M., & Mccaul, K. D. (2007a). Meta-Analysis of the relationship between risk perception and health behavior: The example of vaccination. *Health Psychology, 26,* 136-145.

Brewer, N. T., Cuite, C. L., Herrington, J. E., & Weinstein, N. D. (2007b). Risk compensation and vaccination: Can getting vaccinated cause people to engage in risky behaviors? *Annals of Behavioral Medicine, 34,* 95-99.

Brewer, N. T., Weinstein, N. D., Cuite, C. L., & Herrington, J. E. (2004). Risk perceptions and their relation to risk behavior. *Annals of Behavioral Medicine, 27,* 125-130.

Brown, D. R., Kjaer, S. K., Sigurdsson, K., Iversen, O. E., Hernandez-Avila, M., Wheeler, C. M. et al. (2009). The impact of quadrivalent human papillomavirus (HPV; types 6, 11, 16, and 18) L1 virus-like particle vaccine on infection and disease due to oncogenic nonvaccine HPV types in generally HPV-naive women aged 16-26 years. *Journal of Infectious Diseases, 199,* 926-935.

Brown, K. F., Kroll, J. S., Hudson, M. J., Ramsay, M., Green, J., Long, S. J. et al. (2010). Factors underlying parental decisions about combination childhood vaccinations including MMR: A systematic review. *Vaccine, 28,* 4235-4248.

Buhi, E. R. & Goodson, P. (2007). Predictors of adolescent sexual behavior and intention: A theory-guided systematic review. *Journal of Adolescent Health, 40,* 4-21.

Calloway, C., Jorgensen, C. M., Saraiya, M., & Tsui, J. (2006). A content analysis of news coverage of the HPV vaccine by U.S. newspapers, January 2002-June 2005. *Journal of Women's Health, 15,* 803-809.

Carlson, B. E. (1990). Adolescent observers of marital violence. *Journal of Family Violence, 5,* 285.

Caskey, R., Lindau, S., & Alexander, G. C. (2008). Attitudes and uptake of the HPV vaccine among adolescent girls and young women: Results of a nationally representative survey. *Journal of General Internal Medicine, 23,* 255.

Castellsague, X., Bosch, F. X., Munoz, N., Meijer, C. J. L. M., Shah, K. V., de Sanjose, S. et al. (2002). Male circumcision, penile human papillomavirus infection, and cervical cancer in female partners. *New England Journal of Medicine, 346,* 1105-1112.

Centers for disease control (2009). *National, state and local vaccination coverage among adolescents aged 13-17 years - United States, 2008* (Rep. No. 58(36)).

Centers for disease control (2010). HPV vaccine information for young women. http://www.cdc.gov/std/hpv/STDFact-HPV-vaccine-young-women.htm#hpvvac4 [On-line].

Cervical Screening Wales (2010). Cervical screening programme Wales. 2008/2009. http://www.screeningservices.org.uk/csw/prof/reports/KC53-61-65_08-09.pdf [On-line].

Chan, S. S. C., Cheung, T. H., Lo, W. K., & Chung, T. K. H. (2007). Women's attitudes on human papillomavirus vaccination to their daughters. *Journal of Adolescent Health, 41,* 204-207.

Chao, C., Slezak, J. M., Coleman, K. J., & Jacobsen, S. J. (2009a). Papanicolaou screening behavior in mothers and human papillomavirus vaccine uptake in adolescent girls. *American Journal of Public Health, 99,* 1137-1142.

Chao, C., Velicer, C., Slezak, J. M., & Jacobsen, S. J. (2009b). Correlates for completion of 3-dose regimen of HPV vaccine in female members of a managed care organization. *Mayo Clinic Proceedings, 84,* 864-870.

Clancy, C. M., Cebul, R. D., & Williams, S. V. (1988). Guiding individual decisions - A randomized, controlled trial of decision-analysis. *American Journal of Medicine, 84,* 283-288.

Clemens, S., Jotangia, D., Lynch, S., Nicholson, S., & Pigott, S. (2008). Drug use, smoking and drinking among young people in England in 2007. http://www.ic.nhs.uk/webfiles/publications/sdd07/SDD%20Main%20report%2007%20%2808%29-Standard.pdf [On-line].

Cohen, J. (1960). A coefficient of agreement for nominal scales. *Educational and Psychological Measurement, 20,* 37-46.

Conner, M. & Sparks, P. (1995). Theory of Planned Behaviour and Health Behaviours. In M.Conner & C. Norman (Eds.), *Predicting Health Behaviours* (pp. 121-162). Buckingham: Open University Press.

Conner, M. & Sparks, P. (2005). Theory of planned behaviour and health behaviour. In M.Conner & P. Norman (Eds.), *Predicting Health Behaviour* (2 ed., pp. 170-223). Maidenhead: Open University Press.

Conroy, K., Rosenthal, S. L., Zimet, G. D., Jin, Y., Bernstein, D. I., & Kahn, J. A. (2009). Human papillomavirus vaccine uptake, barriers to vaccination, and predictors of vaccination in young women. *Journal of Adolescent Health, 44,* S12.

Constantine, N. A. & Jerman, P. (2007). Acceptance of human papillomavirus vaccination among Californian parents of daughters: A representative statewide analysis. *Journal of Adolescent Health, 40,* 108-115.

Cooper, H. (2002). Investigating socio-economic explanations for gender and ethnic inequalities in health. *Social Science & Medicine, 54,* 693-706.

Crosbie, E. J. & Brabin, L. (2010). Cervical cancer: problem solved? Vaccinating girls against human papillomavirus. *BJOG, 117,* 137-142.

Cuzick, J., Castanon, A., & Sasieni, P. (2010). Predicted impact of vaccination against human papillomavirus 16/18 on cancer incidence and cervical abnormalities in women aged 20-29 in the UK. *British Journal of Cancer, 102,* 933-939.

Dahlstrom, L. A., Tran, T. N., Lundholm, C., Young, C., Sundstrom, K., & Sparen, P. (2010). Attitudes to HPV vaccination among parents of children aged 12-15 years-a population-based survey in Sweden. *International Journal of Cancer, 126,* 500-507.

Davis, K., Dickman, E. D., Ferris, D., & Dias, J. K. (2004). Human papillomavirus vaccine acceptability among parents of 10- to 15-year-old adolescents. *Journal of Lower Genital Tract Disease, 8,* 188-194.

De Carvalh, N., Roteli-Martin, C. M., Teixeira, J., Naud, P., de Borba, P., Zahaf, T. et al. (2009). Immunogenicity and safety of HPV-16/18 AS04-adjuvanted vaccine up to 7.3 years. In *25th IPV conference*.

de Gonzalez, A. B. & Green, J. (2007). Comparison of risk factors for invasive squamous cell carcinoma and adenocarcinoma of the cervix: Collaborative reanalysis of individual data on 8,097 women with squamous cell carcinoma and 1,374 women with adenocarcinoma from 12 epidemiological studies. *International Journal of Cancer, 120,* 885-891.

de Sanjose, S., Diaz, M., Castellsague, X., Clifford, G., Bruni, L., Munoz, N. et al. (2007). Worldwide prevalence and genotype distribution of cervical human papillomavirus DNA in women with normal cytology: a meta-analysis. *The Lancet Infectious Diseases, 7,* 453-459.

de Visser, R. & McDonnell, E. (2008). Correlates of parents' reports of acceptability of human papilloma virus vaccination for their school-aged children. *Sexual Health, 5,* 331-338.

Deacon, J. M., Evans, C. D., Yule, R., Desai, M., Binns, W., Taylor, C. et al. (2000). Sexual behaviour and smoking as determinants of cervical HPV infection and of CIN3 among those infected: a case-control study nested within the Manchester cohort. *British Journal of Cancer, 83,* 1565-1572.

Dempsey, A. F., Zimet, G. D., Davis, R. L., & Koutsky, L. (2005). Factors that are associated with parental acceptance of human papillomavirus vaccines: A randomized intervention study of written information about HPV. *Pediatrics, 117,* 1486-1493.

Department for Children Schools and Families (2007). *Teenage parents next steps: guidance for LAs and Primary Care Trusts*.

Department for Children Schools and Families (2010a). *Teenage pregnancy strategy: beyond 2010*.

Department for Children Schools and Families (2010b). Teenage pregnancy: Statistics. http://www.dcsf.gov.uk/everychildmatters/healthandwellbeing/teenagepregnancy/statistics/statistics/ [On-line].

Department for Education and Skills (2006). Schools and Pupils in England: January (2006). http://www.dcsf.gov.uk/rsgateway/DB/SFR/s000682/SFR38-2006.pdf [On-line].

Department of Health (2009). HPV vaccination programme: Provisional data, as submitted by PCTs, for first, second and third dose vaccine uptake, for the month ending 31 August 2009. http://www.immunisation.nhs.uk/publications/HPV_VaccineUptake_Aug2009.pdf [On-line].

Department of Health (2010). Annual HPV uptake in England: 2008/09. http://www.dh.gov.uk/prod_consum_dh/groups/dh_digitalassets/@dh/@en/@ps/documents/digitalasset/dh_111676.pdf [On-line].

Diefenbach, M. A., Weinstein, N. D., & O'Reilly, J. (1993). Scales for assessing perceptions of health hazard susceptibility. *Health Education Research, 8,* 181-192.

Diiorio, C., Pluhar, E., & Belcher, L. (2003). Parent-child communication about sexuality A review of the literature from 1980-2002. *Journal of HIV/AIDS Prevention & Education for Adolescents & Children, 5,* 7-32.

DiIoro, C., Kelley, M., & Hockenberry-Eaton, M. (1999). Communication about sexual issues: Mothers, fathers, and friends. *Journal of Adolescent Health, 24,* 181-189.

Donders, G. G. G., Gabrovska, M., Bellen, G., van Keirsbilck, J., van den Bosch, T., Riphagen, I. et al. (2008). Knowledge of cervix cancer, human papilloma virus (HPV) and HPV vaccination at the moment of introduction of the vaccine in women in Belgium. *Archives of Gynecology and Obstetrics, 277,* 291-298.

Donnelly, J., Goldfarb, E. S., Ferraro, H., Eadie, C., & Duncan, D. F. (2001). Assessing sexuality attitudes and behaviors and correlates of alcohol and drugs. *Psychological Reports, 88,* 849-853.

Douglas, M. & Wildavsky, A. (1982). *Risk and Culture*. Los Angeles: Berkeley.

Dunn, R. A., Shenouda, P. E., Martin, D. R., & Schultz, A. J. (1998). Videotape increases parent knowledge about poliovirus vaccines and choices of polio vaccination schedules. *Pediatrics, 102,* E261-E266.

Epstein, S. (1991). Cognitive-experiential self-theory: An integrative theory of personality. In R.Curtis (Ed.), *The relational self: Convergences in psychoanalysis and social psychology* (pp. 111-137). New York: Guilford Press.

European Centre for Disease Prevention and Control (ECDC) (2010). Guidance for the Introduction of HPV Vaccines in EU Countries. Stockholm, January, 2008. http://ecdc.europa.eu [On-line].

Evans, L. (1985). Human-behavior feedback and traffic safety. *Human Factors, 27,* 555-576.

Falagas, M. E. & Zarkadoulia, E. (2008). Factors associated with suboptimal compliance to vaccinations in children in developed countries: a systematic review. *Current Medical Research and Opinion, 24,* 1719-1741.

Faul, F., Erdfelder, E., Lang, A. G., & Buchner, A. (2007). G*Power [Computer software]. Germany: Universitat Kiel.

Fenton, K. A., Johnson, A. M., McManus, S., & Erens, B. (2001a). Measuring sexual behaviour: Methodological challenges in survey research. *Sexually Transmitted Infections, 77,* 84-92.

Fenton, K. A., Korovessis, C., Johnson, A. M., McCadden, A., McManus, S., Wellings, K. et al. (2001b). Sexual behaviour in Britain: reported sexually transmitted infections and prevalent genital Chlamydia trachomatis infection. *The Lancet, 358,* 1851-1854.

Ferguson, S. A., Lund, A. K., & Greene, M. A. (1995). *Driver fatalities in 1985-1994 air bag cars*. Arlington: Insurance Institute for Highway Safety.

Ferlay, J., Bray, F., Pisani, P., & Parkin, D. M. (2004). *GLOBOCAN 2002: Cancer incidence, mortality and prevalence worldwide* (Rep. No. IARC CancerBase No. 5. version 2.0). Lyon: IARC*Press*.

Ferris, D. G. M., Cromwell, L. B., Waller, J. L. P., & Horn, L. B. (2010). Most parents do not think receiving human papillomavirus vaccine would encourage sexual activity in their children. *Journal of Lower Genital Tract Disease, 14,* 179-184.

Festinger, L. (1957). *A theory of cognitive dissonance.* Stanford, CA: Standford University Press.

Fischhoff, B., Slovic, P., Lichtenstein, S., Read, S., & Combs, B. (1978). How safe is safe enough - Psychometric study of attitudes towards technological risks and benefits. *Policy Sciences, 9,* 127-152.

Fishbein, M. & Ajzen, I. (1975). *Belief, Attitude, Intention and Behavior*. New York: Wiley.

Franceschi, S. (2009). EUROGIN 2008 roadmap on cervical cancer prevention. *International Journal of Cancer, 125,* 2246-2255.

Gerend, M. A. & Magloire, Z. F. (2008). Awareness, knowledge, and beliefs about human papillomavirus in a racially diverse sample of young adults. *Journal of Adolescent Health, 42,* 237-242.

Gerend, M. A. & Shepherd, J. E. (2007). Using message framing to promote acceptance of the human papillomavirus vaccine. *Health Psychology, 26,* 745-752.

Gerend, M. A., Shepherd, J. E., & Money, D. M. (2008). Behavioral frequency moderates the effects of message framing on HPV vaccine acceptability. *Annals of Behavioral Medicine, 32,* 221-229.

Gerend, M. A., Weibley, E., & Bland, H. (2009). Parental response to human papillomavirus vaccine availability: Uptake and intentions. *Journal of Adolescent Health, 45,* 528-531.

Gibbons, F. X., Gerrard, M., Cleveland, M. J., Wills, T. A., & Brody, G. (2004). Perceived discrimination and substance use in African American parents and their children: a panel study. *Journal of Personality and Social Psychology, 86,* 517-529.

Gibbons, F. X., Gerrard, M., Ouellette, J. A., & Burzette, R. (1998). Cognitive antecedents to adolescent health risk: Discriminating between behavioral intention and behavioral willingness. *Psychology & health, 13,* 319-339.

Gillespie, L., Banas, D., Tang, A. S., Worley, S., & Rome, E. S. (2008). Acceptability of the HPV vaccine among parents of newborn to ten year old children. *Journal of Pediatric and Adolescent Gynecology, 21,* 58.

Gottvall, M., Larsson, M., Hoglund, A. T., & Tyden, T. (2009). High HPV vaccine acceptance despite low awareness among Swedish upper secondary school students. *European Journal of Contraception and Reproductive Health Care, 14,* 399-405.

Gray, R. H., Kigozi, G., Serwadda, D., Makumbi, F., Watya, S., Nalugoda, F. et al. (2007). Male circumcision for HIV prevention in men in Rakai, Uganda: a randomised trial. *Lancet, 369,* 657-666.

Grayson, D. (2004). Some myths and legends in quantitative psychology. *Understanding statistics, 3,* 101-134.

Gredig, D., Niderost, S., & Parpan-Blaser, A. (2007). Explaining the condom use of heterosexual men in a high-income country: Adding somatic culture to the theory of planned behaviour. [References]. *Journal of Public Health, 15,* 129-140.

Greene, G. & Davies, M. (2008). Parental perceptions of human papillomavirus vaccination: examining the bases of resistance using innovative reviewing methods. *Journal of Epidemiology and Community Health, 62,* A31.

Griffith, A. H. (1981). Medicine and the media--vaccination against whooping cough. *Journal of biological standardization, 9,* 475-482.

Guardian News and Media Limited (2008a). National daily newspaper circulation December 2007. http://media.guardian.co.uk/presspublishing/table/0,,2241617,00.html [On-line].

Guardian News and Media Limited (2008b). National Sunday newspaper circulation - December 2007. http://media.guardian.co.uk/presspublishing/table/0,,2241628,00.html [On-line].

Habel, M. A., Liddon, N., & Stryker, J. E. (2009). The HPV vaccine: A content analysis of online news stories. *Journal of Womens Health, 18,* 401-407.

Hackett, A. J. (2008). Risk, its perception and the media: the MMR controversy. *Community Practitioner, 81,* 22-25.

Hargreaves, I., Lewis, J., & Speers, T. (2003). *Towards a better map: Science, the public and the media*. Cardiff: Cardiff University.

Harrington, P., Woodman, C., & Shannon, W. (1995). Childhood immunisation uptake in the Republic of Ireland. *Irish Medical Journal, 88,* 153-154.

Harrison, J. A., Mullen, P. D., & Green, L. W. (1992). A meta-analysis of studies of the health belief model with adults. *Health Education Research, 7,* 107-116.

Health Protection Agency (2008). *Sexually transmitted infections in young people in the United Kingdom: 2008 report* London.

Health Protection Agency (2010). Completed Primary Courses at Two Years of Age: England and Wales, 1966 - 1977, England only 1978 onwards. http://www.hpa.org.uk/webw/HPAweb&HPAwebStandard/HPAweb_C/1195733819251?p=1250719645566 [On-line].

Hedlund, J. (2000). Risky business: Safety regulations, risk compensation, and individual behavior. *Injury Prevention, 6,* 82-90.

Higgins, J. P. T. & Green, S. (2009). *Cochrane Handbook for Systematic Reviews of Interventions.* Chichester: John Wiley & Sons, Ltd.

Hilton, S., Hunt, K., Langan, M., Bedford, H., & Petticrew, M. (2010). Newsprint media representations of the introduction of the HPV vaccination programme for cervical cancer prevention in the UK (2005-2008). *Social Science & Medicine, 70,* 942-950.

HMSO Stationery Office, N. N. 1. (1991). Age of legal capacity (Scotland) act.
Ref Type: Bill/Resolution

Hobfoll, S. E., Jackson, A. P., Lavin, J., Britton, P. J., & Shepherd, J. B. (1994). Reducing inner-city womens AIDS risk activities - A study of single, pregnant-women. *Health Psychology, 13,* 397-403.

Hobson-West, P. (2007). 'Trusting blindly can be the biggest risk of all': organised resistance to childhood vaccination in the UK. *Sociology of Health and Illness, 29,* 198-215.

Hoover, D. R., Carfioloi, B., & Moench, E. A. (2000). Attitudes of adolescent/young adult women toward human papillomavirus vaccination and clinical trials. *Health Care for Women International, 21,* 275-391.

Howell-Jones, R., Bailey, A., Beddows, S., Sargent, A., de Silva, N., Wilson, G. et al. (2010). Multi-site study of HPV type-specific prevalence in women with cervical cancer, intraepithelial neoplasia and normal cytology, in England. *Br J Cancer, 103,* 209-216.

Hutchinson, M. K., Jemmott, J. B., Jemmott, L. S., Braverman, P., & Fong, G. T. (2003). The role of mother-daughter sexual risk communication in reducing sexual risk behaviors among urban adolescent females: A prospective study. *Journal of Adolescent Health, 33,* 98-107.

Information Services, N. S. (2009). Cervical Screening. http://www.isdscotland.org/isd/1673.html [On-line].

Ingledue, K., Cottrell, R., & Bernard, A. (2004). College women's knowledge, perceptions, and preventive behaviors regarding human papillomavirus infection and cervical cancer. *American Journal of Health Studies, 19,* 28-34.

Jacobson, V. J. & Szilagyi, P. (2005). Patient reminder and patient recall systems to improve immunization rates. *Cochrane Database of Systematic Reviews, 20,* CD003941.

Jain, N., Stokley, S., & Yankey, D. (2008). *Vaccination coverage among adolescents aged 13-17 years - United States, 2007* (Rep. No. 57(40)).

Jefferies, S., McShane, S., Oerton, J., Victor, C. R., & Beardow, R. (1991). Low immunization uptake rates in an inner-city health district: fact or fiction? *Journal of Public Health Medicine, 13,* 312-317.

Johnson, A. M., Mercer, C. H., Erens, B., Copas, A. J., McManus, S., Wellings, K. et al. (2001). Sexual behaviour in Britain: partnerships, practices, and HIV risk behaviours. *The Lancet, 358,* 1835-1842.

Kaestle, C. E., Morisky, D. E., & Wiley, D. J. (2002). Sexual intercourse and the age difference between adolescent females and their romantic partners. *Perspectives on Sexual and Reproductive Health, 34,* 304-309.

Kahane, C. J. (1994). Fatality reduction by automatic occupant protection systems in the United States. In *14th International technical conference on enhanced safety of vehicles* Washington DC: Department of Transportation.

Kahane, C. J. (1996). *Fatality reduction by air bags: analysis of accident data through early 1996.* Washington DC: Department of Transportation.

Kahn, J. A., Rosenthal, S. L., Jin, Y., Huang, B., Namakydoust, A., & Zimet, G. D. (2008). Rates of human papillomavirus vaccination, attitudes about vaccination, and human papillomavirus prevalence in young women. *Obstetrics and Gynecology, 111,* 1103-1110.

Kahn, J. A., Ding, L., Huang, B., Zimet, G. D., Rosenthal, S. L., & Frazier, A. L. (2009). Mothers' Intention for Their Daughters and Themselves to Receive the Human Papillomavirus Vaccine: A National Study of Nurses. *Pediatrics, 123,* 1439-1445.

Kahn, J. A., Goodman, E., Slap, G. B., Huang, B., & Emans, S. J. (2001). Intention to return for Papanicolaou smears in adolescent girls and young women. *Pediatrics, 108,* 333-341.

Kahneman, D. & Tversky, A. (1979). Prospect theory: an analysis of decision under risk. *Econometrica, 47,* 263-291.

Kasperson, R. E., Renn, O., Slovic, P., Brown, H. S., Emel, J., Goble, R. et al. (1988). The social amplification of risk - A conceptual-framework. *Risk Analysis, 8,* 177-187.

Kelly, B. J., Leader, A. E., Mittermaier, D. J., Hornik, R. C., & Cappella, J. N. (2009). The HPV vaccine and the media: How has the topic been covered and what are the effects on knowledge about the virus and cervical cancer? *Patient Education and Counseling, 77,* 308-313.

Kim, J. J. & Goldie, S. J. (2009). Cost effectiveness analysis of including boys in a human papillomavirus vaccination programme in the United States. *British Medical Journal, 339,* b3884.

Kjaer, S. K., Chackerian, B., van den Brule, A. J. C., Svare, E. I., Paull, G., Walbomers, J. M. M. et al. (2001). High-risk human papillomavirus is sexually transmitted: Evidence from a follow-up study of virgins starting sexual activity (intercourse). *Cancer Epidemiology Biomarkers & Prevention, 10,* 101-106.

Kline, P. (1999). *The handbook of psychological testing*. (2 ed.) London: Routledge.

Klug, S. J., Hukelmann, M., & Blettner, M. (2008). Knowledge about infection with human papillomavirus: A systematic review. *Preventative Medicine, 46,* 87-98.

Koulova, A., Tsui, J., Irwin, K., Van Damme, P., Biellik, R., & Aguado, M. T. (2008). Country recommendations on the inclusion of HPV vaccines in national immunization programmes among high-income countries, June 2006-January 2008. *Vaccine, 26,* 6529-6541.

Leask, J., Jackson, C., Trevena, L., McCaffery, K., & Brotherton, J. (2009). Implementation of the Australian HPV vaccination program for adult women: Qualitative key informant interviews. *Vaccine, 27,* 5505-5512.

Lenselink, C. H., Gerrits, M. M. J. G., Melchers, W. J. G., Massuger, L. F. A. G., van Hamont, D., & Bekkers, R. L. M. (2008). Parental acceptance of human papillomavirus vaccines. *European Journal of Obstetrics & Gynecology and Reproductive Biology, 137,* 103-107.

Lipkus, I. M., Kuchibhatla, M., McBride, C. M., Bosworth, H. B., Pollak, K. I., Siegler, I. C. et al. (2000). Relationships among breast cancer perceived absolute risk, comparative risk, and worries. *Cancer Epidemiology Biomarkers Prevention, 9,* 973-975.

Lipkus, I. M., Samsa, G., & Rimer, B. K. (2001). General performance on a numeracy scale among highly educated samples. *Medical Decision Making, 21,* 37-44.

Lund, A. K. & Ferguson, S. A. (1995). Driver fatalities in 1985-1993 cars with airbags. *The Journal of trauma, 38,* 469.

Lund, A. K. & Zador, P. (1984). Mandatory belt use and driver risk taking. *Risk Analysis, 4,* 41.

Lupton, D. (1998). Medicine and health care in popular media. In A.Brechin, J. Walmsley, J. Katz, & S. Peace (Eds.), *Care matters: concepts, practice and research in health and social care* (pp. 194-207). London: Sage.

Marin, B. V., Kirby, D. B., Hudes, E. S., Coyle, K. K., & Gomez, C. A. (2006). Boyfriends, girlfriends and teenagers' risk of sexual involvement. *Perspectives on Sexual and Reproductive Health, 38,* 76-83.

Marlow, L. A. V., Forster, A. S., Wardle, J., & Waller, J. (2008). Mothers' and adolescents' beliefs about risk compensation following HPV vaccination. *Journal of Adolescent Health, 44,* 446-451.

Marlow, L. A. V., Waller, J., Evans, R. E. C., & Wardle, J. (2009). Predictors of interest in HPV vaccination: A study of British adolescents. *Vaccine, 27,* 2483-2488.

Marlow, L. A. V., Waller, J., & Wardle, J. (2007a). Parental attitudes to pre-pubertal HPV vaccination. *Vaccine, 25,* 1945-1952.

Marlow, L. A. V., Waller, J., & Wardle, J. (2007b). Trust and experience as predictors of HPV vaccine acceptance. *Human Vaccines, 3,* 171-175.

Marston, C. & King, E. (2006). Factors that shape young people's sexual behaviour: a systematic review. *The Lancet, 368,* 1581-1586.

Marteau, T. M., Hankins, M., & Collins, B. (2002). Perceptions of risk of cervical cancer and attitudes towards cervical screening: a comparison of smokers and non-smokers. *Family Practice, 19,* 18-22.

Mathur, M. B., Mathur, V. S., & Reichling, D. B. (2010). Participation in the decision to become vaccinated against human papillomavirus by California high school girls and the predictors of vaccine status. *Journal of Pediatric Health Care, 24,* 14-24.

Mays, R. M., Sturm, L. A., & Zimet, G. D. (2004). Parental perspectives on vaccinating children against sexually transmitted infections. *Social Science & Medicine, 58,* 1405-1413.

McRee, A. L., Brewer, N., Reiter, P., Smith, J., & Gottlieb, S. (2010). HPV vaccine: What are mothers saying to their adolescent daughters? *Journal of Adolescent Health, 46,* S69.

Menashe, C. L. & Siegel, M. (1998). The power of a frame: an analysis of newspaper coverage of tobacco issues--United States, 1985-1996. *Journal of Health Communication, 3,* 307-325.

Microsoft Corporation (2003). Microsoft Office Excel [Computer software].

Milne, S., Sheeran, P., & Orbell, S. (2000). Prediction and intervention in health-related behavior: A meta-analytic review of protection motivation theory. *Journal of Applied Social Psychology, 30,* 106-143.

Monsonego, J. (2007). *The end of a cancer?* (1 ed.) Paris: ESKA Publishing.

Moreno, V., Bosch, F. X., Mu±oz, N., Meijer, C. J., Shah, K. V., Walboomers, J. M. et al. (2002). Effect of oral contraceptives on risk of cervical cancer in women with human papillomavirus infection: the IARC multicentric case-control study. *The Lancet, 359,* 1085-1092.

Morison, L. A., Cozzolino, P. J., & Orbell, S. (2010). Temporal perspective and parental intention to accept the human papillomavirus vaccination for their daughter. *British Journal of Health Psychology, 15,* 151-165.

Morrison-Beedy, D., Carey, M. P., Cote-Arsenault, D., Seibold-Simpson, S., & Robinson, K. A. (2008). Understanding sexual abstinence in urban adolescent girls. *Journal of Obstetric Gynecologic and Neonatal Nursing, 37,* 185-195.

Mortensen, G. L. (2010). Drivers and barriers to acceptance of human-papillomavirus vaccination among young women: a qualitative and quantitative study. *Bmc Public Health, 10,* 68.

Nardelli-Haefliger, D., Lurati, F., Wirthner, D., Spertini, F., Schiller, J. T., Lowy, D. R. et al. (2005). Immune responses induced by lower airway mucosal immunisation with a human papillomavirus type 16 virus-like particle vaccine. *Vaccine, 23,* 3634-3641.

Natan, M. B., Aharon, O., Palickshvili, S., & Gurman, V. (2010). Attitude of Israeli mothers with vaccination of their daughters against human papilloma virus. *Journal of Pediatric Nursing, In Press, Corrected Proof.*

National Office of Statistics (2007). The National Statistics Socio-economic Classification. National Office of Statistics [On-line]. Available: http://www.statistics.gov.uk/methods_quality/ns_sec/

National Public Health Services for Wales (2009). Vaccine Uptake in Children in Wales April to June 2009. www.wales.nhs.uk/sites3/searchresultssql.cfm?orgid=457&q=COVER [On-line].

Neubrand, T. P. L., Radecki Breitkopf, C., Rupp, R., Breitkopf, D., & Rosenthal, S. L. (2009). Factors associated with completion of the human papillomavirus vaccine series. *Clinical Pediatrics, 48,* 966-969.

Newspaper Marketing Agency (2009). NMA marketplace charts. http://www.docstoc.com/docs/9879345/NMA-Marketplace-Charts [On-line].

NHS Cancer Screening Programmes (2010). Cervical screening: The Facts. http://www.cancerscreening.nhs.uk/cervical/publications/nhscsp-the-facts-english-large-print.pdf [On-line].

NHS Choices (2010). Vaccinations: Your NHS guide to vaccinations for you and your family. http://www.nhs.uk/Planners/vaccinations/Pages/Mythsandtruths.aspx [On-line].

NHS National Services Scotland (2008). Human Papilloma Virus (HPV) Immunisation Uptake rates: 2008/09. http://www.isdscotland.org/isd/5921.html [On-line].

NHS Plus & The Clinical Effectiveness Forum (2009). *A review of grading systems and critical appraisal tools* Bristol: NHS Plus.

NICE (2007). Prevention of sexually transmitted infections and under 18 conceptions: guidance. http://guidance.nice.org.uk/PH3/Guidance/pdf/English [On-line].

Norman, C. & Conner, M. (1993). The role of social cognition models in predicting attendance at health checks. *Psychology and Health, 8,* 447-462.

Norman, P. & Brain, K. (2005). An application of an extended health belief model to the prediction of breast self-examination among women with a family history of breast cancer. *British Journal of Health Psychology, 10,* 1-16.

Northern Ireland Executive (2009). Health Minister announces HPV vaccine uptake figures and catch up programme. http://www.northernireland.gov.uk/news/news-dhssps/news-dhssps/news-dhssps-march-2009//news-dhssps-30032009-health-minister-announces.htm [On-line].

O'Connor, A. M., Rostom, A., Fiset, V., Tetroe, J., Entwhistle, V., Llewellyn-Thomas, H. et al. (1999). Decision aids for patients facing health treatment or screening decisions: systematic review. *British Medical Journal, 319,* 731-734.

O'Donnell, L., Wilson-Simmons, R., Dash, K., Jeanbaptiste, V., Myint, U., Moss, J. et al. (2007). Saving sex for later: Developing a parent-child communication intervention to delay sexual initiation among young adolescents. *Sex Education, 7,* 107-125.

O'Neill, B. (1977). Decision-Theory Model of Danger Compensation. *Accident Analysis and Prevention, 9,* 157-165.

O'Neill, B. & Lund, A. K. (1993). The effectiveness of air bags in preventing driver fatalities in the United States. In *Proceedings of the international conference on air bags and seat belts: evaluation and implications for public policy* Montreal: Health and Welfare Canada.

O'Neill, B. & Williams, A. (1998). Risk homeostasis hypothesis: A rebuttal. *Injury Prevention, 4,* 92-93.

Office for National Statistics (2001). Census 2001: count me in. http://www.statistics.gov.uk/census2001/pdfs/H1.pdf [On-line].

Office for National Statistics. (2003). Ethnic group by religion, for local authorities. Newport, Controller Office of Public Sector Information.
Ref Type: Data File

Office for National Statistics (2008). Participation of 16 to 18 year olds in education and training, England, 2007 and 2008. http://www.dcsf.gov.uk/rsgateway/DB/SFR/s000849/index.shtml [On-line].

Office for National Statistics (2009). Opinions Survey Report No. 41: Contraception and Sexual Heath, 2008/09. http://www.statistics.gov.uk/downloads/theme_health/contra2008-9.pdf [On-line].

Office of the United Nations High Commissioner for Human Rights. (1989). Convention on the Rights of the Child. Adopted and opened for signature, ratification and accession by General Assembly resolution 44/25 of 20 November 1989.
Ref Type: Bill/Resolution

Offit, P. (2008). *Autism's false prophets: bad science, risky medicine, and the search for a cure*. New York: Columbia University Press.

Ogilvie, G., Anderson, M., Marra, F., McNeil, S., Pielak, K., Dawar, M. et al. (2010). A population-based evaluation of a publicly funded, school-based HPV vaccine program in British Columbia, Canada: parental factors associated with HPV vaccine receipt. *PLOS Medicine, 7,* e1000270.

Ogilvie, G. S., Remple, V. P., Fawziah, M., Mcneil, S. A., Monika, N., Karen, L. P. et al. (2007). Parental intention to have daughters receive the human papillomavirus vaccine. *Canadian Medical Association Journal, 177,* 1506-1512.

Olshen, E., Woods, E. R., Austin, B., Luskin, M., & Bauchner, H. (2005). Parental acceptance of the human papillomavirus vaccine. *Journal of Adolescent Health, 37,* 248-251.

Orbell, S., Hodgkins, S., & Sheeran, P. (1997). Implementation intentions and the theory of planned behavior. *Personality and Social Psychology Bulletin, 23,* 945-954.

Paavonen, J., Naud, P., Salmer≤n, J., Wheeler, C. M., Chow, S. N., Apter, D. et al. (2009). Efficacy of human papillomavirus (HPV)-16/18 AS04-adjuvanted vaccine against cervical infection and precancer caused by oncogenic HPV types (PATRICIA): final analysis of a double-blind, randomised study in young women. *The Lancet, 374,* 301-314.

Palefsky, J. (2006). Biology of HPV in HIV infection. *Advances in Dental Research, 19,* 99-105.

Palefsky, J. M. (2010). Human Papillomavirus-Related Disease in Men: Not Just a Women's Issue. *Journal of Adolescent Health, 46,* S12-S19.

Palefsky, J. M. & Holly, E. A. (2003). Chapter 6: Immunosuppression and co-infection with HIV. *J Natl Cancer Inst Monogr,* 41-46.

Parkin, D. M. (2006). The global health burden of infection -associated cancers in the year 2002. *International Journal of Cancer, 118,* 3030-3044.

Parkin, D. M. & Bray, F. (2006). Chapter 2: The burden of HPV-related cancers. *Vaccine, 24,* S11-S25.

Peltzman, S. (1975). Effects of Automobile Safety Regulation. *Journal of Political Economy, 83,* 677-725.

Perkins, R. B., Pierre-Joseph, N., Marquez, C., Iloka, S., & Clark, J. A. (2010). Why do low-income minority parents choose human papillomavirus vaccination for their daughters? *The Journal of Pediatrics, In Press, Corrected Proof.*

Peterson, S., Hoffer, G., & Millner, E. (1995). Are drivers of air-bag-equipped cars more aggressive? A test of the offsetting behavior hypothesis. *Journal of Law and Economics, 38,* 251-264.

Petrie, J., Barnwell, E., & Grimshaw J. (1995). Criteria for appraisal for national use. Pilot Edition. Scottish Intercollegiate Guidelines Network. http://www.sign.ac.uk/methodology/index.html [On-line].

Pinkerton, S. D. (2001). Sexual Risk Compensation and HIV/STD Transmission: Empirical Evidence and Theoretical Considerations. *Risk Analysis, 21,* 727-736.

Pitts, M. K., Dyson, S. J., Rosenthal, D. A., & Garland, S. M. (2007). Knowledge and awareness of human papillomavirus (HPV): attitudes towards HPV vaccination among a representative sample of women in Victoria, Australia. *Sexual Health, 4,* 177-180.

Podolsky, R., Cremer, M., Atrio, J., Hochman, T., & Arslan, A. A. (2009). HPV vaccine acceptability by Latino parents: A comparison of U.S. and Salvadoran populations. *Journal of Pediatric and Adolescent Gynecology, 22,* 205-215.

Porter, S. R. & Whitcomb, M. E. (2005). Non-response in student surveys: The role of demographics, engagement and personality. *Research in Higher Education, 46,* 127-152.

Prentice-Dunn, S., Mcmath, B. F., & Cramer, R. J. (2009). Protection motivation theory and stages of change in sun protective behavior. *Journal of Health Psychology, 14,* 297-305.

Price, J. H., Easton, A. N., Telljohann, S. K., & Wallace, P. B. (1996). Perceptions of cervical cancer and pap smear screening behavior by women's sexual orientation. *Journal of Community Health, 21,* 89-105.

Public Health Agency for Northern Ireland (2006). Cervical screening statistics. http://www.cancerscreening.n-i.nhs.uk/statistics/wstats05.html#P-4_0 [On-line].

Quilliam, S. (2006). Cervical cancer and the human papillomavirus vaccine. *Journal of Family Planning and Reproductive Health Care, 32,* 119-120.

Quinn, M., Babb, P., Brock, A., Kirby, L., & Jones, J. (2001). Cancer Trends in England & Wales 1950-1999. http://www.statistics.gov.uk/downloads/theme_health/cancertrends_5099.pdf [On-line].

Rambout, L., Hopkins, L., Hutton, B., & Fergusson, D. (2007). Prophylactic vaccination against human papillomavirus infection and disease in women: a systematic review of randomized controlled trials. *Canadian Medical Association Journal, 177,* 469-479.

Read, D. S., Joseph, M. A., Polishchuk, V., & Suss, A. L. (2010). Attitudes and perceptions of the HPV vaccine in Caribbean and African-American adolescent girls and their parents. *Journal of Pediatric and Adolescent Gynecology, 23,* 242-245.

Reed Elsevier Ltd (2008). NexisUK [Computer software]. London: Reed Elsevier (UK) Ltd.

Reiter, P. L., Cates, J. R., McRee, A. L., Gottlieb, S. L., Shafer, A., Smith, J. S. et al. (2010). Statewide HPV vaccine initiation among adolescent females in North Carolina. *Sexually Transmitted Diseases.*

Reiter, P. L., Brewer, N. T., Gottlieb, S. L., McRee, A. L., & Smith, J. S. (2009). Parents' health beliefs and HPV vaccination of their adolescent daughters. *Social Science & Medicine, 69,* 475-480.

Renner, B., Schuz, B., & Sniehotta, F. F. (2008). Preventive health behavior and adaptive accuracy of risk perceptions. *Risk Analysis, 28,* 741-748.

Reventlow, S., Hvas, A. C., & Tulinius, C. (2001). "In really great danger ..." - The concept of risk in general practice. *Scandinavian Journal of Primary Health Care, 19,* 71-75.

Richard, R. & van der Pligt, J. (1991). Factors affecting condom use among adolescents. *Journal of community & applied social psychology, 1,* 105-116.

Rise, J., Kovac, V., Kraft, P., & Moan, I. S. (2008). Predicting the intention to quit smoking and quitting behaviour: Extending the theory of planned behaviour. *British Journal of Health Psychology, 13,* 291-310.

Ritchie, J. & Spencer, L. (2000). Qualitative data analysis for applied policy research. In A.Bryman & R. G. Burgess (Eds.), *Analyzing Qualitative Data* (pp. 173-194). London: Routledge.

Rivis, A. & Sheeran, P. (2003). Descriptive norms as an additional predictor in the theory of planned behaviour: A meta-analysis. *Current Psychology, 22,* 218-233.

Robb, K. A., Miles, A., & Wardle, J. (2007). Perceived Risk of Colorectal Cancer: Sources of Risk Judgments. *Cancer Epidemiology Biomarkers & Prevention, 16,* 694-702.

Robbins, S. C. C., Bernard, D., McCaffery, K., Brotherton, J., Garland, S., & Skinner, S. R. (2010). "Is cancer contagious?": Australian adolescent girls and their parents: Making the most of limited information about HPV and HPV vaccination. *Vaccine, 28,* 3398-3408.

Roberts, M. E., Gerrard, M., Reimer, R., & Gibbons, F. X. (2010). Mother-daughter communication and human papillomavirus vaccine uptake by college students. *Pediatrics, 125,* 982-989.

Robertson, L. & Pless, B. (2002). Does risk homoeostasis theory have implications for road safety. *British Medical Journal, 324,* 1149-1152.

Rogers, R. W. (1975). A protection motivation theory of fear appeals and attitude change. *Journal of Psychology, 91,* 93-114.

Rogers, R. W. (1983). Cognitive and physiological processes in fear appeals and attitude change: a revised theory of protection motivation. In J.T.Cacioppo & R.E.Petty (Eds.), *Social Psychophysiology* (pp. 153-176). New York: Guilford Press.

Rosenstock, I. M. (1966). Why people use health services. *The Milbank Memorial Fund Quarterly, 44,* 94-127.

Rosenstock, I. M., Strecher, V. J., & Becker, M. H. (1988). Social Learning Theory and the Health Belief Model. *Health Education & Behavior, 15,* 175-183.

Rothman, A. J. & Salovey, P. (1997). Shaping perceptions to motivate healthy behavior: The role of message framing. *Psychological Bulletin, 121,* 3-19.

Saewyc, E., Taylor, D., Homma, Y., & Ogilvie, G. (2008). Trends in sexual health and risk behaviours among adolescent students in British Columbia. *Canadian Journal of Human Sexuality, 17,* 1-13.

Salmon, D. A., Moulton, L. H., Omer, S. B., deHart, M. P., Stokley, S., & Halsey, N. A. (2005). Factors associated with refusal of childhood vaccines among parents of school-aged children: A case-control study. *Archives of Pediatrics and Adolescent Medicine, 159,* 470-476.

Sam, I. C., Wong, L. P., Rampal, S., Leong, Y. H., Pang, C. F., Tai, Y. T. et al. (2009). Maternal acceptance of human papillomavirus vaccine in Malaysia. *Journal of Adolescent Health, 44,* -610.

Sanderson, M., Coker, A. L., Eggleston, K. S., Fernandez, M. E., Arrastia, C. D., & Fadden, M. K. (2009). HPV vaccine acceptance among latina mothers by HPV status. *Journal of Womens Health, 18,* 1793-1799.

Sankaranarayanan, R., Budukh, A. M., & Rajkumar, R. (2001). Effective screening programmes for cervical cancer in low- and middle-income developing countries. *Bulletin of the World Health Organization, 79,* 954-962.

Sasieni, P., Adams, J., & Cuzick, J. (2003). Benefit of cervical screening at different ages: evidence from the UK audit of screening histories. *British Journal of Cancer, 89,* 88-93.

Schwartz, L. M., Woloshin, S., Black, W. C., & Welch, H. G. (1997). The role of numeracy in understanding the benefit of screening mammography. *Annals of Internal Medicine, 127,* 966-972.

Schwarzer, R. (1992). Self-efficacy in the adoption and maintenance of health behaviors: Theoretical approaches and a new model. In R.Schwarzer (Ed.), *Self-efficacy: Thought control of action* (pp. 217-243). Washington, DC: Hemisphere.

Schwarzer, R. (2001). Social-cognitive factors in changing health-related behaviors. *Current directions in psychological science, 10,* 47-51.

Sheeran, P. (2002). Intention-behaviour relations: A conceptual and empirical review. In W.Strobe & M. Hewstone (Eds.), *European Review of Social Psychology* (12 ed., pp. 1-36). Hoboken, New Jersey: John Wiley & Sons Ltd.

Sheeran, P. & Abraham, C. (2003). Mediator of moderators: Temporal stability of intention and the intention-behavior relation. *Personality and Social Psychology Bulletin, 29,* 205-215.

Shefer, A., Markowitz, L., Deeks, S., Tam, T., Irwin, K., Garland, S. M. et al. (2008). Early experiences with human papillomavirus vaccine introduction in the United States, Canada and Australia. *Vaccine, 26S,* K68-K75.

Sheinfeld-Gorin, S., Wang, C., Raich, P., Bowen, D. J., & Hay, J. (2006). Decision making in cancer primary prevention and chemoprevention. *Annals of Behavioral Medicine, 32,* 179-187.

Sheppard, B. H., Hartwick, J., & Warshaw, R. P. (1988). The Theory of Reasoned Action: A meta-analysis of past research with recommendations for modifications and future research. *Journal of Consumer Research, 15,* 325-343.

Short, M. B., Rosenthal, S. L., Sturm, L., Black, L., Loza, M., Breitkopf, D. et al. (2010). Adult women's attitudes toward the HPV vaccine. *Journal of Womens Health, 19,* 1305-1311.

Simonet, S. & Wilde, G. J. S. (1997). Risk: Perception, acceptance and homeostasis. *Applied Psychology: An International Review, 46,* 235-252.

Smith, J., Bosetti, C., Munoz, N., Herrero, R., Bosch, F. X., Eluf-Neto, J. et al. (2004a). Chlamydia trachomatis and invasive cervical cancer: A pooled analysis of the IARC multicentric case-control study. *International Journal of Cancer, 111,* 431-439.

Smith, J. A. (2002). Evolving issues for qualitative psychology. In J.T.E.Richardson (Ed.), *Handbook of qualitative research methods for psychology and the social sciences* (pp. 189-201). Oxford: BPS Blackwell.

Smith, J. S., Herrero, R., Bosetti, C., Munoz, N., Bosch, F. X., Eluf-Neto, J. et al. (2002). Herpes simplex virus-2 as a human papillomavirus cofactor in the etiology of invasive cervical cancer. *Journal of the National Cancer Institute, 94,* 1604-1613.

Smith, P. J., Chu, S. Y., & Barker, L. E. (2004b). Children who have received no vaccines: Who are they and where do they live? *Pediatrics, 114,* 187-195.

Sparks, P. (1994). Food choice and health: applying, and extending the theory of planned behaviour. In D.R.Rutter & L. Quine (Eds.), *Social Psychology and Health: European Perspectives* (pp. 25-46). Aldershot: Avebury.

Sparks, P. & Shepherd, R. (1992). Self-identity and the theory of planned behavior: Assessing the role of identification with "green consumerism.". *Social Psychology Quarterly, 55,* 1388-1399.

Speers, T. & Lewis, J. (2004). Journalists and jabs: media coverage of the MMR vaccine. *Commun Med, 1,* 171-181.

Spencer, L., Ritchie, J., & O'Connor, A. M. (2003). Analysis: Practices, principles and processes. In J.Ritchie & J. Lewis (Eds.), *Qualitative research practice: A guide for social science students and researchers* (pp. 199-218). London: SAGE publications.

SPSS Inc. (2005). SPSS [Computer software]. Chicago, IL.

Stanley, M. (2008). Immunobiology of HPV and HPV Vaccines. *Gynecologic Oncology, 109,* S15-S21.

Stanley, M. (2006). Immune responses to human papillomavirus. *Vaccine, 24,* S16-S22.

StataCorp LP (2009). STATA SE 11.0 [Computer software]. College Station, TX.

Stephenson, J. M., Strange, V., Oakley, A., Copas, A., Allen, E., Babiker, A. et al. (2004). Pupil-led sex education in England (RIPPLE study): Cluster-randomised intervention trial. *The Lancet, 364,* 338-346.

Stretch, R., Roberts, S. A., McCann, R., Baxter, D., Chambers, G., Kitchener, H. et al. (2008). Parental attitudes and information needs in an adolescent HPV vaccination programme. *British Journal of Cancer, 99,* 1908-1911.

Sturm, L. A., Mays, R. M., & Zimet, G. D. (2005). Parental beliefs and decision making about child and adolescent immunization: From polio to sexually transmitted infections. *Journal of Developmental and Behavioral Pediatrics, 26,* 441-452.

Szarewski, A. (2008). HPV vaccines: peering through the fog. *Journal of Family Planning and Reproductive Health Care, 34,* 207-209.

Testa, A. C. & Coleman, L. M. (2006). Accessing research participants in schools: a case study of a UK adolescent sexual health survey. *Health Education Research, 21,* 518-526.

The FUTURE I/II study group (2010). Four year efficacy of prophylactic human papillomavirus quadrivalent vaccine against low grade cervical, vulvar, and vaginal intraepithelial neoplasia and anogenital warts: randomised controlled trial. *BMJ, 341,* 3493-3502.

The Guardian (2010). Girl who died after cervical cancer injection had tumour in her chest. http://www.guardian.co.uk/society/2009/oct/01/cervical-cancer-vaccination-tumour-natalie-morton [On-line].

The Health and Social Care Information Centre (2009). Cervical screening programme 2008-2009 data tables. http://www.ic.nhs.uk/webfiles/publications/cervscreen0809/Cervical_Screening_Programme_2008_09_Data_Tables_%28revised%29.xls [On-line].

The Information Centre (2009a). NHS Immunisation Statistics England 2008-09. http://www.ic.nhs.uk/statistics-and-data-collections/health-and-lifestyles/immunisation [On-line].

The Information Centre (2009b). Statistics on cervical cancer and the NHS Cervical Screening Programme, 1999 to 2009. http://www.ic.nhs.uk/webfiles/publications/cervscreen0809/Cervical_Screening_Programme_2008_09_Data_Tables_%28revised%29.xls [On-line].

The Information Centre (2010a). Big increase in numbers of women undergoing cervical screening. http://www.ic.nhs.uk/news-and-events/press-office/press-releases/big-increase-in-numbers-of-women-undergoing-cervical-screening [On-line].

The Information Centre (2010b). Cervical screening programme report: 2008-2009. http://www.ic.nhs.uk/webfiles/publications/cervscreen0809/Cervical_%20Screening_Programme_Report_2008_09_(revised).pdf [On-line].

Thompson, M. (2010). Who's guarding what? A poststructural feminist analysis of gardasil discourses. *Health Commun, 25*, 119-130.

Tichenor, P., Donohue, G., & Olien, C. (1970). Mass media flow and differential growth in knowledge. *Public Opinion Quarterly Advance, 34*, 159-170.

Tindall, C. (1998). Issues of evaluation. In P.Bannister, E. Burman, I. Parker, M. Taylor, & C. Tindall (Eds.), *Qualitative methods in psychology: a researchers guide* (pp. 142-159). Buckingham: Open University Press.

Toffolon-Weiss, M., Hagan, K., Leston, J., Peterson, L., Provost, E., & Hennessy, T. (2008). Alaska native parental attitudes on cervical cancer, HPV and the HPV vaccine. *International Journal of Circumpolar Health, 67*, 363-373.

Tourangeau, R. & Smith, T. W. (1996). Asking sensitive questions - The impact of data collection mode, question format, and question context. *Public Opinion Quarterly, 60*, 275-304.

Tozzi, A. E., Ravα, L., Stat, D., Pandolfi, E., Marino, M. G., & Ugazio, A. G. (2009). Attitudes towards HPV immunization of Italian mothers of adolescent girls and potential role of health professionals in the immunization program. *Vaccine, 27*, 2625-2629.

Trafimow, D. (2008). Normative beliefs. http://dccps.nci.nih.gov/brp/constructs/normative_beliefs/normative_beliefs.pdf [On-line].

Tucker, J. S., Ellickson, P. L., Orlando, M., & Klein, D. J. (2006). Cigarette smoking from adolescence to young adulthood: Women's developmental trajectories and associates outcomes. *Women's Health Issues, 16*, 30-37.

Tulloch, H., Reida, R., D'Angeloa, M. S., Plotnikoff, R. C., Morrina, L., Beatona, L. et al. (2009). Predicting short and long-term exercise intentions and behaviour in patients with coronary artery disease: A test of protection motivation theory. *Psychology & health, 24*, 255-269.

Turner-Stokes, L., Harding, R., Sergeant, J., Lupton, C., & McPherson, K. (2006). Generating the evidence base for the national service framework for long term conditions: a new research typology. *Clinical Medicine, 6,* 91-97.

Vickers, A. J. & Altman, D. G. (2001). Analysing controlled trials with baseline and follow up measurements. *British Medical Journal, 323,* 1123-1124.

Villa, L. L., Costa, R. L. R., Petta, C. A., Andrade, R. P., Paavonen, J., Iversen, O. E. et al. (2006). High sustained efficacy of a prophylactic quadrivalent human papillomavirus types 6//11//16//18 L1 virus-like particle vaccine through 5 years of follow-up. *British Journal of Cancer, 95,* 1459-1466.

Walboomers, J. M. M., Jacobs, M. V., Manos, M. M., Bosch, F. X., Kummer, J. A., Shah, K. V. et al. (1999). Human papillomavirus is a necessary cause of invasive cervical cancer worldwide. *Journal of Pathology, 189,* 12-19.

Wallace, L. S. & Ache, K. A. (2009). Hear all about it: nightly television news coverage of cervical cancer vaccination in the United States. *Journal of Lower Genital Tract Disease, 13,* 154-158.

Waller, J., Marlow, L. A. V., & Wardle, J. (2006). Mothers' attitudes towards preventing cervical cancer through human papillomavirus vaccination: A qualitative study. *Cancer Epidemiology, Biomarkers and Prevention, 15,* 1257-1261.

Waller, J., McCaffery, K. J., Forrest, S., & Wardle, J. (2004). Human papillomavirus and cervical cancer: Issues for biobehavioral and psychosocial research. *Annals of Behavioral Medicine, 27,* 68-79.

Wawer, M. J., Makumbi, F., Kigozi, G., Serwadda, D., Watya, S., Nalugoda, F. et al. (2009). Circumcision in HIV-infected men and its effect on HIV transmission to female partners in Rakai, Uganda: a randomised controlled trial. *The Lancet, 374,* 229-237.

Weber, R. P. (1990). *Basic content analysis.* (2 ed.) California: SAGE Publications, Inc.

Wei, F., Mullooly, J. P., Goodman, M., McCarty, M. C., Hanson, A. M., Crane, B. et al. (2009). Identification and characteristics of vaccine refusers. *BMC Pediatrics, 91.*

Weinstein, N. D. (1980). Unrealistic optimism about future life events. *Journal of Personality and Social Psychology, 39,* 806-820.

Weinstein, N. D. (1987). Unrealistic optimism about susceptibility to health-problems - Conclusions from a community-wide sample. *Journal of Behavioral Medicine, 10,* 481-500.

Weinstein, N. D., Kwitel, A., Mccaul, K. D., Magnan, R. E., Gerrard, M., & Gibbons, F. X. (2007). Risk perceptions: Assessment and relationship to influenza vaccination. *Health Psychology, 26,* 146-151.

Weinstein, N. D. (2000). Perceived probability, perceived severity, and health-protective behavior. *Health Psychology, 19,* 65-74.

Wellings, K., Field, J., Wadsworth, J., Johnson, A. M., Anderson, R. M., & Bradshaw, S. A. (1990). Sexual lifestyles under scrutiny. *Nature, 348,* 276-278.

Wellings, K., Nanchahal, K., Macdowall, W., McManus, S., Erens, B., Mercer, C. H. et al. (2001). Sexual behaviour in Britain: early heterosexual experience. *The Lancet, 358,* 1843-1850.

Wells, J., Marshall, P., Crawley, B., & Dickersin, K. (2001). Newspaper reporting of screening mammography. *Annals of Internal Medicine, 135,* 1029-1037.

Wheeler, C. M., Kjaer, S. K., Sigurdsson, K., Iversen, O. E., Hernandez-Avila, M., Perez, G. et al. (2009). The impact of quadrivalent human papillomavirus (HPV; types 6, 11, 16, and 18) L1 virus-like particle vaccine on infection and disease due to oncogenic nonvaccine HPV types in sexually active women aged 16-26 years. *Journal of Infectious Diseases, 199,* 936-944.

Wilde, G. J. S. (1976). The risk compensation theory of accident causation and its practical consequences for accident prevention. *Osterreichische Gesellschaft fur Unfallchirurgie*.

Wilde, G. J. S. (1982). The theory of risk homeostasis: Implications for safety and health. *Risk Analysis, 2,* 209-225.

Wilde, G. J. S. (2002). Does risk homoeostasis theory have implications for road safety. *British Medical Journal, 324,* 1149-1152.

Williams, C. E., Povey, R. C., & White, D. G. (2008). Predicting women's intentions to use pain relief medication during childbirth using the Theory of Planned Behaviour and Self-Efficacy Theory. *Journal of Reproductive and Infant Psychology*.

Winer, R. L., Hughes, J. P., Feng, Q. H., O'Reilly, S., Kiviat, N. B., Holmes, K. K. et al. (2006). Condom use and the risk of genital human papillomavirus infection in young women. *New England Journal of Medicine, 354,* 2645-2654.

Winer, R. L., Kiviat, N. B., Hughes, J. P., Adam, D. E., Lee, S. K., Kuypers, J. M. et al. (2005). Development and duration of human papillomavirus lesions, after initial infection. *Journal of Infectious Diseases, 191,* 731-738.

Winer, R. L., Lee, S. K., Hughes, J. P., Adam, D. E., Kiviat, N. B., & Koutsky, L. A. (2003). Genital human papillomavirus infection: Incidence and risk factors in a cohort of female university students. *American Journal of Epidemiology, 157,* 218-226.

Woloshin, S., Schwartz, L. M., Byram, S., Fischhoff, B., & Welch, H. G. (2000). A new scale for assessing perceptions of chance: A validation study. *Medical Decision Making, 20,* 298-307.

Wong, L. P. (2009a). Role of men in promoting the uptake of HPV vaccinations: focus groups' finding from a developing country. *International Journal of Public Health, 55,* 35-42.

Wong, L. P. (2008). Young multiethnic women's attitudes toward the HPV vaccine and HPV vaccination. *International Journal of Gynecology & Obstetrics, 103,* 131-135.

Wong, L. P. (2009b). HPV information needs, educational messages and channel of delivery preferences: views from developing country with multiethnic populations. *Vaccine, 27,* 1410-1415.

Woodhall, S. C., Lehtinen, M., Verho, T., Huhtala, H., Hokkanen, M., & Kosunen, E. (2007). Anticipated acceptance of HPV vaccination at the baseline of implementation: A survey of parental and adolescent knowledge and attitudes in Finland. *Journal of Adolescent Health, 40,* 466-469.

Woods, J. L., Shew, M. L., Tu, W., Ofner, S., Ott, M. A., & Fortenberry, J. D. (2006). Patterns of Oral Contraceptive Pill-taking and Condom Use among Adolescent Contraceptive Pill Users. *Journal of Adolescent Health, 39,* 381-387.

World Health Organisation (2006). *Preparing for the introduction of HPV vaccines: Policy and programme guidance for countries.* Geneva: World Health Organisation.

World Health Organisation (2010). Sexually transmitted infections. http://www.who.int/mediacentre/factsheets/fs110/en/ [On-line].

Wu, J. P. M., Porch, E. M., McWeeney, M. P., Ohman-Strickland, P. P., & Levine, J. P. M. (2010). Knowledge and concerns related to the human papillomavirus vaccine among underserved Latina women. *Journal of Lower Genital Tract Disease, 14,* 155-161.

Yamagishi, K. (1997). When a 12.86% mortality is more dangerous than 24.14%: Implications for risk communication. *Applied Cognitive Psychology, 11,* 495-506.

Yeganeh, N., Curtis, D., & Kuo, A. (2010). Factors influencing HPV vaccination status in a Latino population; and parental attitudes towards vaccine mandates. *Vaccine, 28,* 4186-4191.

Yin, R. (1989). *Case study research: design and methods.* (Revised ed.) Newbury Park, California: Sage.

Zador, P. L. & Ciccone, M. A. (1993). Automobile driver fatalities in frontal impacts - air bags compared with manual belts. *American Journal of Public Health, 83,* 661-666.

Zimet, G. D., Fortenberry, J. D., Fife, K. H., Tyring, S. K., Herne, K., & Douglas, J. M. (1997). Acceptability of genital herpes immunization - The role of health beliefs and health behaviors. *Sexually Transmitted Diseases, 24,* 555-560.

Zimet, G. D., Liddon, N., Rosenthal, S. L., Lazcano-Ponce, E., & Allen, B. (2006). Psychosocial aspects of vaccine acceptability. *Vaccine, 24,* 201-209.

Zimet, G. D., Mays, R. M., Sturm, L. A., Ravert, A. A., Perkins, S. M., & Juliar, B. E. (2005). Parental attitudes about sexually transimitted infection vaccination for their adolescent children. *Archives of Pediatric and Adolescent Health, 159,* 132-137.

Zimet, G. D., Perkins, S. M., Sturm, L. A., Bair, R. M., Juliar, B. E., & Mays, R. M. (2007). Predictors of STI vaccine acceptability among parents and their adolescent children. *Journal of Adolescent Health, 37,* 179-186.

Zimmer-Gembeck, M. J. & Helfand, M. (2008). Ten years of longitudinal research on US adolescent sexual behavior: Developmental correlates of sexual intercourse, and the importance of age, gender and ethnic background. *Developmental Review, 28,* 153-224.

APPENDIX 1- SEARCH TERMS AND NUMBER OF ARTICLES DOWNLOADED

Database	No. downloaded	Search terms
Embase	271	1. behavior/ 2. exp patient attitude/ 3. exp treatment refusal/ 4. exp health care utilization/ 5. 4 or 1 or 3 or 2 6. exp immunization/ 7. exp vaccine/ 8. 6 or 7 9. exp adolescent/ 10. exp infant/ 11. exp newborn/ 12. exp child/ 13. *girl/ 14. *boy/ 15. *daughter/ 16. son.mp. [mp=title, abstract, subject headings, heading word, drug trade name, original title, device manufacturer, drug manufacturer name] 17. exp child/ 18. *childhood/ 19. exp socioeconomics/ 20. exp income/ 21. exp ethnic group/ 22. exp education/ 23. *correlation analysis/ 24. *predictor variable/ 25. exp attitude/ or exp attitude to health/ or exp attitude to illness/ or exp patient attitude/ or exp student attitude/ 26. exp health/ 27. 25 or 21 or 26 or 20 or 22 or 24 or 19 or 23 28. 11 or 9 or 17 or 12 or 15 or 14 or 18 or 10 or 13 or 16 29. 27 and 8 and 28 and 5 30. from 29 keep 1-407 31. limit 30 to (english and yr="2004 -Current" and (article or journal or "review"))
MedLine	537	1. exp intention/ 2. exp "Patient Acceptance of Health Care"/ 3. exp patient compliance/ or exp treatment refusal/ 4. exp Patient Compliance/ 5. 4 or 1 or 3 or 2 6. exp adolescent/ or exp child/ or exp infant/ or exp parents/ 7. exp Nuclear Family/ 8. 6 or 7 9. exp immunization programs/ or exp mass immunization/ 10. exp Immunization/ 11. exp Vaccines/ 12. 11 or 10 or 9 13. exp socioeconomic factors/ 14. exp Ethnic Groups/ 15. exp attitude/ or exp attitude to health/ 16. (correlat* or predict* or determinant*).mp. [mp=title, original title, abstract, name of substance word, subject heading word] 17. 16 or 13 or 15 or 14 18. 8 and 17 and 12 and 5 19. limit 18 to (english language and english) 20. limit 19 to (yr="2004 -Current" and english and (introductory journal article or journal article or meta analysis or "review"))
PsychInfo	2	1. exp Intention/ 2. exp Health Care Utilization/ 3. exp Treatment Compliance/ 4. 1 or 3 or 2 5. *immunization/

		6. socioeconomic status/ 7. "racial and ethnic groups"/ 8. exp "income (economic)"/ or exp income level/ 9. attitudes/ or exp adolescent attitudes/ or exp health attitudes/ or exp parental attitudes/ 10. exp Health Knowledge/ 11. adult attitudes/ 12. exp educational attainment level/ 13. 8 or 6 or 11 or 7 or 10 or 9 or 12 14. *adolescent attitudes/ 15. exp parents/ or exp fathers/ or exp mothers/ 16. *daughters/ 17. *sons/ 18. (child* or infant or newborn or pre?school).mp. [mp=title, abstract, heading word, table of contents, key concepts] 19. 17 or 18 or 15 or 16 or 14 20. 4 and 19 and 13 and 5 21. limit 20 to ("0110 peer-reviewed journal" and english and yr="2004 -Current")
Health Management Information Consortium	0	1. exp patient compliance/ 2. exp patient cooperation/ 3. exp health service utilisation/ 4. exp young people/ 5. exp neonates/ 6. exp children/ 7. exp pre school children/ 8. exp girls/ 9. exp boys/ 10. exp daughters/ 11. 1 or 3 or 2 12. 8 or 6 or 4 or 7 or 10 or 9 or 5 13. exp IMMUNISATION RATES/ or exp IMMUNISATION/ or exp IMMUNISATION SERVICES/ 14. exp vaccines/ 15. 13 or 14 16. exp "sociology of economics"/ 17. exp income/ 18. exp ethnic groups/ 19. exp educational performance/ 20. exp patient knowledge/ 21. exp attitudes/ or exp patient attitudes/ 22. exp risk factors/ 23. (correlat* or predict* or determinant*).mp. [mp=title, other title, abstract, heading words] 24. 21 or 17 or 20 or 22 or 18 or 16 or 19 or 23 25. 11 and 24 and 12 and 15 26. limit 25 to (yr="2004 -Current" and journal)
CINAHL	6	Limits: English language, peer review, article, review or systematic review, 2004-2009. S47 S38 and S39 and S45 S46 S29 and S38 and S39 and S45 S45 S40 or S41 or S42 or S43 or S44 S44 TX (determinant*) or (predict*) or (correlat*) S43 (MM "Risk Factors+") S42 (MM "Health Knowledge") S41 (MM "Attitude+") S40 (MM "Socioeconomic Factors+") S39 S35 or S36 or S37 S38 S30 or S31 or S32 or S33 or S34 S37 (MM "Vaccines+") S36 (MM "Immunization Programs") S35 (MM "Immunization+") S34 (MM "Sons") S33 (MM "Daughters")

		S32 (MM "Child+") S31 (MM "Infant") S30 (MM "Adolescence") S29 S25 or S26 or S27 or S28 S28 (MM "Patient Compliance+") S27 (MM "Health Resource Utilization") S26 (MM "Treatment Refusal") S25 (MM "Intention") S24 S14 and S15 and S21 S23 S14 and S15 and S21 S22 S5 and S14 and S15 and S21 S21 S16 or S17 or S18 or S19 or S20 S20 TX (determinant*) or (predict*) or (correlat*) S19 (MM "Risk Factors+") S18 (MM "Health Knowledge") S17 (MM "Attitude+") S16 (MM "Socioeconomic Factors+") S15 S11 or S12 or S13 S14 S6 or S7 or S8 or S9 or S10 S13 (MM "Vaccines+") S12 (MM "Immunization Programs") S11 (MM "Immunization+") S10 (MM "Sons") S9 (MM "Daughters") S8 (MM "Child+") S7 (MM "Infant") S6 (MM "Adolescence") S5 S1 or S2 or S3 or S4 S4 (MM "Patient Compliance+") S3 (MM "Health Resource Utilization") S2 (MM "Treatment Refusal") S1 (MM "Intention")
Web of science	173	# 6 #5 AND Language=(English) AND Document Type=(Article OR Review) *Databases=SCI-EXPANDED, SSCI, A&HCI, CPCI-S Timespan=2004-2009* # 5 #4 AND #3 AND #2 AND #1 *Databases=SCI-EXPANDED, SSCI, A&HCI, CPCI-S Timespan=2004-2009* # 4 Topic=((Adolescent*) or (infant*) or (newborn*) or (child*) or (girl*) or (boy*) or (daughter*) or (son*) or (pre?school)) *Databases=SCI-EXPANDED, SSCI, A&HCI, CPCI-S Timespan=2004-2009* # 3 Topic=((immuni?ation*) or (vaccine*) or (immuni?ation rate*) or (immuni?ation program*)) *Databases=SCI-EXPANDED, SSCI, A&HCI, CPCI-S Timespan=2004-2009* # 2 Topic=((Behavio?r) or (patient attitude) or (treatment refusal) or (health?care utili?ation) or (intention) or (patient acceptance of health?care) or (patient compliance) or (treatment refusal) or (treatment compliance) or (patient cooperation) or (health service utili?ation) or (health resource utili?ation) or (adherence)) *Databases=SCI-EXPANDED, SSCI, A&HCI, CPCI-S Timespan=2004-2009* # 1 Topic=((Socio?economic*) or (income*) or (ethnic group*) or (education*) or (education status) or (correlation analysis) or (predictor variable*) or (attitude*) or (attitude* to health) or (attitude* to illness) or (patient attitude*) or (student attitude*) or (health) or (correlate*) or (predict*) or (determinant*) or (risk factor*) or (knowledge) or (health knowledge)) *Databases=SCI-EXPANDED, SSCI, A&HCI, CPCI-S Timespan=2004-2009*
Cochrane Database of Systematic Reviews	0	# 6 #5 AND Language=(English) AND Document Type=(Article OR Review) Databases=SCI-EXPANDED, SSCI, A&HCI, CPCI-S Timespan=2004-2009 # 5 #4 AND #3 AND #2 AND #1 Databases=SCI-EXPANDED, SSCI, A&HCI, CPCI-S Timespan=2004-2009 # 4 Topic=((Adolescent*) or (infant*) or (newborn*) or (child*) or (girl*) or (boy*) or (daughter*) or (son*) or (pre?school)) Databases=SCI-EXPANDED, SSCI, A&HCI, CPCI-S Timespan=2004-2009 # 3 Topic=((immuni?ation*) or (vaccine*) or (immuni?ation rate*) or (immuni?ation program*)) Databases=SCI-EXPANDED, SSCI, A&HCI, CPCI-S Timespan=2004-2009 # 2 Topic=((Behavio?r) or (patient attitude) or (treatment refusal) or

		(health?care utili?ation) or (intention) or (patient acceptance of health?care) or (patient compliance) or (treatment refusal) or (treatment compliance) or (patient cooperation) or (health service utili?ation) or (health resource utili?ation) or (adherence)) Databases=SCI-EXPANDED, SSCI, A&HCI, CPCI-S Timespan=2004-2009 # 1 Topic=((Socio?economic*) or (income*) or (ethnic group*) or (education*) or (education status) or (correlation analysis) or (predictor variable*) or (attitude*) or (attitude* to health) or (attitude* to illness) or (patient attitude*) or (student attitude*) or (health) or (correlate*) or (predict*) or (determinant*) or (risk factor*) or (knowledge) or (health knowledge)) Databases=SCI-EXPANDED, SSCI, A&HCI, CPCI-S Timespan=2004-2009

APPENDIX 2- INCLUDED REFERENCES AND ID NUMBER

3 Allison, M. A., Crane, L. A., Beaty, B. L., Davidson, A. J., Melinkovich, P., & Kempe, A. (2007). School-based health centers: Improving access and quality of care for low-income adolescents. *Pediatrics, 120:*e887-e894.

4 Bair, R. M., Mays, R. M., Sturm, L. A., & Zimet, G. D. (2008). Acceptability of the human papillomavirus vaccine among Latina mothers. *Journal of Pediatric & Adolescent Gynecology, 21,* 329-334

6 Berger, L. M., Hill, J., & Waldfogel, J. (2005). Maternity leave, early maternal employment and child health and development in the US. *Economic Journal, 115,* F29-F47.

8 Brabin, L., Roberts, S. A., Stretch, R., Baxter, D., Chambers, G., Kitchener, H. et al. (2008). Uptake of first two doses of human papillomavirus vaccine by adolescent schoolgirls in Manchester: prospective cohort study. *British Medical Journal, 336,* 1056-1058.

9 Brewer, N. T. & Fazekas, K. I. (2007). Predictors of HPV vaccine acceptability: a theory-informed, systematic review. *Preventive Medicine, 45,* 107-114.

10 Cassell, J. A., Leach, M., Poltorak, M. S., Mercer, C. H., Iversen, A., & Fairhead, J. R. (2006). Is the cultural context of MMR rejection a key to an effective public health discourse? *Public Health, 120,* 783-794.

11 Cates, J. R., Brewer, N. T., Fazekas, K. I., Mitchell, C. E., & Smith, J. S. (2009). Racial differences in HPV knowledge, HPV vaccine acceptability, and related beliefs among rural, southern women. *Journal of Rural Health, 25,* 93-97.

12 Chao, C., Slezak, J. M., Coleman, K. J., & Jacobsen, S. J. (2009). Papanicolaou screening behavior in mothers and human papillomavirus vaccine uptake in adolescent girls. *American Journal of Public Health. 99(6):1137-42, 99,* 1137-1142.

13 Constantine, N. A. & Jerman, P. (2007). Acceptance of human papillomavirus vaccination among Californian parents of daughters: a representative statewide analysis. *Journal of Adolescent Health, 40,* 108-115.

14 Dannetun, E., Tegnell, A., Hermansson, G., & Giesecke, J. (2005). Parents' reported reasons for avoiding MMR vaccination. A telephone survey. *Scandinavian Journal of Primary Health Care, 23,* 149-153.

15 de, Visser, R. & McDonnell, E. (2008). Correlates of parents' reports of acceptability of human papilloma virus vaccination for their school-aged children. *Sexual Health, 5,* 331-338.

17 Dempsey, A. F., Zimet, G. D., Davis, R. L., & Koutsky, L. (2006). Factors that are associated with parental acceptance of human papillomavirus vaccines: a randomized intervention study of written information about HPV. *Pediatrics, 117,* 1486-1493.

18 Dempsey, A. F., Abraham, L. M., Dalton, V., & Ruffin, M. (2009). Understanding the reasons why mothers do or do not have their adolescent daughters vaccinated against human papillomavirus. *Annals of Epidemiology, 18,* 531-538

19 Di, G. G., Abbate, R., Liguori, G., Albano, L., & Angelillo, I. F. (2008). Human papillomavirus and vaccination: knowledge, attitudes, and behavioural intention in adolescents and young women in Italy. *British Journal of Cancer, 99,* 225-229.

20 Falagas, M. E. & Zarkadoulia, E. (2008). Factors associated with suboptimal compliance to vaccinations in children in developed countries: a systematic review. *Current Medical Research & Opinion, 24,* 1719-1741.

22 Friederichs, V., Cameron, J. C., & Robertson, C. (2006). Impact of adverse publicity on MMR vaccine uptake: a population based analysis of vaccine uptake records for one million children, born 1987-2004. *Archives of Disease in Childhood, 91,* 465-468.

23 Gellatly, J., McVittie, C., & Tiliopoulos, N. (2005). Predicting parents' decisions on MMR immunisation: A mixed method investigation. *Family Practice, 22,* 658-662.

24 Grant, D., Kravitz-Wirtz, N., Breen, N., Tiro, J. A., & Tsui, J. (2009). One in four California adolescent girls have had human papillomavirus vaccination. *Policy Brief, PB2009-3,* 1-6.

25 Gullion, J. S., Henry, L., & Gullion, G. (2008). Deciding to opt out of childhood vaccination mandates. *Public Health Nursing, 25(5):401-8, 25,* 401-408.

26 Gust, D. A., Darling, N., Kennedy, A., & Schwartz, B. (2008). Parents with doubts about vaccines: Which vaccines and reasons why. *Pediatrics, 122,* 718-725.

28 Kahn, J. A., Ding, L., Huang, B., Zimet, G. D., Rosenthal, S. L., & Frazier, A. L. (2009). Mothers' intention for their daughters and themselves to receive the human papillomavirus vaccine: A national study of nurses. *Pediatrics, 123,* 1439-1445.

29 Kennedy, A. M. & Gust, D. A. (2008). Measles outbreak associated with a church congregation: a study of immunization attitudes of congregation members. *Public Health Reports, 123(2):126-34, 123,* 126-134.

30 Kim, S. S., Frimpong, J. A., Rivers, P. A., & Kronenfeld, J. J. (2007). Effects of maternal and provider characteristics on up-to-date immunization status of children aged 19 to 35 months. *American Journal of Public Health, 97,* 259-266

31 Koller, D. & Mielck, A. (2009). Regional and social differences concerning overweight, participation in health check-ups and vaccination. Analysis of data from a whole birth cohort of 6-year old children in a prosperous German city. *Bmc Public Health, 9.*

32 Loring, B. J. & Curtis, E. T. (2009). Routine vaccination coverage of 11 year olds, by ethnicity, through school-based vaccination in South Auckland. *New Zealand Medical Journal, 122,* 14-21.

33 Marlow, L. A., Waller, J., & Wardle, J. (2008). Sociodemographic predictors of HPV testing and vaccination acceptability: results from a population-representative sample of British women. *Journal of Medical Screening, 15,* 91-96.

34 Marlow, L. A., Waller, J., Evans, R. E., & Wardle, J. (2009). Predictors of interest in HPV vaccination: A study of British adolescents. *Vaccine, 27,* 2483-2488.

35 Marshall, H., Ryan, P., Roberton, D., & Baghurst, P. (2007). A cross-sectional survey to assess community attitudes to introduction of Human papillomavirus vaccine. *Australian & New Zealand Journal of Public Health, 31,* 235-242.

36 Matsumura, T., Nakayama, T., Okamoto, S., & Ito, H. (2005). Measles vaccine coverage and factors related to uncompleted vaccination among 18-month-old and 36-month-old children in Kyoto, Japan. *Bmc Public Health, 5.*

37 Meyerhoff, A. S. & Jacobs, R. J. (2005). Do too many shots due lead to missed vaccination opportunities? Does it matter? *Preventive Medicine, 41,* 540-544.

38 Mindlin, M., Jenkins, R. and Law, C. (2009). Maternal employment and indicators of child health: a systematic review in pre-school children in OECD countries. *Journal of Epidemiology and Community Health* 63 (5):340-350.

39 Minkovitz, C. S., Strobino, D., Scharfstein, D., Hou, W., Miller, T., Mistry, K. B. et al. (2005). Maternal depressive symptoms and children's receipt of health care in the first 3 years of life. *Pediatrics, 115,* 306-314.

40 Niederhauser, V. P. & Markowitz, M. (2007). Barriers to immunizations: Multiethnic parents of under- and unimmunized children speak. *Journal of the American Academy of Nurse Practitioners., 19,* 15-23.

41 Ogilvie, G. S., Remple, V. P., Marra, F., Mcneil, S. A., Naus, M., Pielak, K. L. et al. (2007). Parental intention to have daughters receive the human papillomavirus vaccine. *Canadian Medical Association Journal, 177,* 1506-1512.

42 Pearce, A., Law, C., Elliman, D., Cole, T. J., Bedford, H., & Millennium Cohort Study Child Health Group (2008). Factors associated with uptake of measles, mumps, and rubella vaccine (MMR) and use of single antigen vaccines in a contemporary UK cohort: prospective cohort study. *British Medical Journal, 336,* 754-757.

43 Pearce, A., Elliman, D., Law, C., Bedford, H., & Millennium Cohort Study Child Health Group (2009). Does primary immunisation status predict MMR uptake? *Archives of Disease in Childhood, 94,* 49-51.

44 Porter-Jones, G., Williams, S., Powell, C., Pusey, L., & Roberts, R. J. (2009). Impact of a novel way to communicate information about MMR on uptake of MMR vaccine: a randomized controlled trial. *Public Health, 123(1):*78-80.

45 Rosenthal, S. L., Rupp, R., Zimet, G. D., Meza, H. M., Loza, M. L., Short, M. B. et al. (2008). Uptake of HPV vaccine: Demographics, sexual history and values, parenting style, and vaccine attitudes. *Journal of Adolescent Health, 43,* 239-245

46 Salmon, D. A., Moulton, L. H., Omer, S. B., deHart, M. P., Stokley, S., & Halsey, N. A. (2005). Factors associated with refusal of childhood vaccines among parents of school-aged children: A case-control study. *Archives of Pediatrics and Adolescent Medicine, 159,* 470-476.

47 Schempf, A. H., Minkovitz, C. S., Strobino, D. M., & Guyer, B. (2007). Parental satisfaction with early pediatric care and immunization of young children: the mediating role of age-appropriate well-child care utilization. *Archives of Pediatrics & Adolescent Medicine, 161,* 50-56.

49 Agius, P. A., Pitts, M. K., Smith, A. M. A., & Mitchell, A. Human papillomavirus and cervical cancer: Gardasil vaccination status and knowledge amongst a nationally representative sample of Australian secondary school students. *Vaccine, 7;28(27)*:4416-4422.

50 Short, M. B. & Rosenthal, S. L. (2006). Fostering acceptance of human papillomavirus and herpes simplex virus vaccines among adolescents and parents. *Current Opinion in Pediatrics, 18,* 53-57.

51 Slomovitz, B. M., Sun, C. C., Frumovitz, M., Soliman, P. T., Schmeler, K. M., Pearson, H. C. et al. (2006). Are women ready for the HPV vaccine? *Gynecologic Oncology, 103,* 151-154.

52 Stampi, S., Ricci, R., Ruffilli, I., & Zanetti, F. (2005). Compulsory and recommended vaccination in Italy: evaluation of coverage and non-compliance between 1998-2002 in Northern Italy. *Bmc Public Health, 5*.

53 Tozzi, A. E., Rava, L., Stat, D., Pandolfi, E., Marino, M. G., & Ugazio, A. G. (2009). Attitudes towards HPV immunization of Italian mothers of adolescent girls and potential role of health professionals in the immunization program. *Vaccine, 27,* 2625-2629.

54 van der Wal, M. F., Diepenmaat, A. C., Pel, J. M., & Hirasing, R. A. (2005). Vaccination rates in a multicultural population. *Archives of Disease in Childhood, 90,* 36-40.

56 Watts, L. A., Joseph, N., Wallace, M., Rauh-Hain, J. A., Muzikansky, A., Growdon, W. B. et al. (2009). HPV vaccine: A comparison of attitudes and behavioral perspectives between Latino and non-Latino women. *Gynecologic Oncology, 112,* 577-582.

58 Woodhall, S. C., Lehtinen, M., Verho, T., Huhtala, H., Hokkanen, M., & Kosunen, E. (2007). Anticipated acceptance of HPV vaccination at the baseline of implementation: a survey of parental and adolescent knowledge and attitudes in Finland. *Journal of Adolescent Health, 40,* 466-469.

59 Wroe, A. L., Bhan, A., Salkovskis, P., & Bedford, H. (2005). Feeling bad about immunising our children. *Vaccine, 23,* 1428-1433.

62 Zuzak, T. J., Zuzak-Siegrist, I., Rist, L., Staubli, G., & Simoes-Wust, A. P. (2008). Attitudes towards vaccination: Users of complementary and alternative medicine versus non-users. *Swiss Medical Weekly, 138,* 713-718.

63 Chao, C., Velicer, C., Slezak, J. M., & Jacobsen, S. J. (2009). Correlates for completion of 3-dose regimen of HPV vaccine in female members of a managed care organization. *Mayo Clinic Proceedings, 84,* 864-870.

64 Marlow, L. A., Wardle, J., & Waller, J. (2009). Attitudes to HPV vaccination among ethnic minority mothers in the UK: an exploratory qualitative study. *Human Vaccines, 5,* 105-110.

65 Brabin, L., Roberts, S. A., Stretch, R., Baxter, D., Elton, P., Kitchener, H. et al. (2009). A survey of adolescent experiences of human papillomavirus vaccination in the Manchester study. *British Journal of Cancer, 101(9):*1502-1504.

67 Weisberg, E., Bateson, D., McCaffery, K., & Skinner, S. R. (2009). HPV vaccination catch up program - Utilisation by young Australian women. *Australian Family Physician, 38,* 72-76.

69 Sturm, L. A., Mays, R. M., & Zimet, G. D. (2005). Parental beliefs and decision making about child and adolescent immunization: From polio to sexually transmitted infections. *Journal of Developmental and Behavioral Pediatrics, 26,* 441-452.

70 Tickner, S., Leman, P. J., & Woodcock, A. (2006). Factors underlying suboptimal childhood immunisation. *Vaccine, 24,* 7030-7036.

71 Toffolon-Weiss, M., Hagan, K., Leston, J., Peterson, L., Provost, E., & Hennessy, T. (2008). Alaska native parental attitudes on cervical cancer, HPV and the HPV vaccine. *International Journal of Circumpolar Health, 67,* 363-373.

72 Waller, J., Marlow, L. A. V., & Wardle, J. (2006). Mothers' attitudes towards preventing cervical cancer through human papillomavirus vaccination: A qualitative study. *Cancer Epidemiology, Biomarkers and Prevention, 15,* 1257-1261

73 Gerend, M. A., Weibley, E., & Bland, H. (2009). Parental response to human papillomavirus vaccine availability: Uptake and intentions. *Journal of Adolescent Health, 45,* 531.

74 Stretch, R., Roberts, S. A., McCann, R., Baxter, D., Chambers, G., Kitchener, H. et al. (2008). Parental attitudes and information needs in an adolescent HPV vaccination programme. *British Journal of Cancer, 99,* 1908-1911

75 Reiter, P. L., Brewer, N. T., Gottlieb, S. L., McRee, A. L., & Smith, J. S. Parents' health beliefs and HPV vaccination of their adolescent daughters. *Social Science & Medicine, 69(3):*475-480.

76 Sperber, N. R., Brewer, N. T., & Smith, J. S. (2008). Influence of parent characteristics and disease outcome framing on HPV vaccine acceptability among rural, Southern women. *Cancer Causes & Control, 19,* 115-118.

77 Marlow, L. A. V., Waller, J., & Wardle, J. (2007). Trust and experience as predictors of HPV vaccine acceptance. *Human Vaccines, 3,* 171-175.

78 Dempsey, A., Cohn, L., Dalton, V., & Ruffin, M. Patient and clinic factors associated with adolescent human papillomavirus vaccine utilization within a university-based health system. *Vaccine,* 28(4):989-995.

79 Mathur, M. B., Mathur, V. S., & Reichling, D. B. Participation in the decision to become vaccinated against human papillomavirus by California high school girls and the predictors of vaccine status. *Journal of Pediatric Health Care, 24(1):*14-24.

80 Podolsky, R., Cremer, M., Atrio, J., Hochman, T., & Arslan, A. A. (2009). HPV vaccine acceptability by Latino parents: A comparison of U.S. and Salvadoran populations. *Journal of Pediatric and Adolescent Gynecology, 22,* 205-215.

81 Lenselink, C. H., Gerrits, M. M. J. G., Melchers, W. J. G., Massuger, L. F. A. G., van Hamont, D., & Bekkers, R. L. M. (2008). Parental acceptance of human papillomavirus vaccines. *European Journal of Obstetrics & Gynecology and Reproductive Biology, 137,* 103-107.

82 Marlow, L. A. V., Waller, J., & Wardle, J. (2007). Parental attitudes to pre-pubertal HPV vaccination. *Vaccine, 25,* 1945-1952

84 Jain, N., Stokley, S., & Yankey, D. (2008). *Vaccination coverage among adolescents aged 13-17 years - United States, 2007* (Rep. No. 57(40).

85 Kahn, J. A., Rosenthal, S. L., Jin, Y., Huang, B., Namakydoust, A., & Zimet, G. D. (2008). Rates of human papillomavirus vaccination, attitudes about vaccination, and human papillomavirus prevalence in young women. *Obstetrics and Gynecology, 111,* 1103-1110.

86 Neubrand, T. P. L., Radecki Breitkopf, C., Rupp, R., Breitkopf, D., & Rosenthal, S. L. (2009). Factors associated with completion of the human papillomavirus vaccine Series. *Clinical Pediatrics, 48,* 966-969.

87 Caskey, R., Lindau, S. T., & Caleb Alexander, G. Knowledge and early adoption of the HPV vaccine among girls and young women: Results of a national survey. *Journal of Adolescent Health, 5(5)*:453-462.

88 Zimet, G. D. (2009). Potential barriers to HPV immunization: From public health to personal choice. *American Journal of Law & Medicine, 35,* 389-399.

89 Conroy, K., Rosenthal, S. L., Zimet, G. D., Jin, Y., Bernstein, D. I., & Kahn, J. A. (2009). Human papillomavirus vaccine uptake, barriers to vaccination, and predictors of vaccination in young women. *Journal of Adolescent Health, 44,* S12.

90 Reiter, P. L., Brewer, N. T., Gottlieb, S. L., McRee, A. L., & Smith, J. S. How much will it hurt? HPV vaccine side effects and influence on completion of the three-dose regimen A. *Vaccine, 27(49):*6840-6844.

91 Natan, M. B., Aharon, O., Palickshvili, S., & Gurman, V. Attitude of Israeli mothers with vaccination of their daughters against human papilloma virus. *Journal of Pediatric Nursing, in Press*.

92 Yeganeh, N., Curtis, D., & Kuo, A. Factors influencing HPV vaccination status in a Latino population; and parental attitudes towards vaccine mandates. *Vaccine, 28(25)*:4186-4191.

93 Reiter, P. L., Cates, J. R., McRee, A. L., Gottlieb, S. L., Shafer, A., Smith, J. S. et al. (2010). Statewide HPV vaccine initiation among adolescent females in North Carolina. *Sexually Transmitted Diseases, in press.*

94 McRee, A. L. M., Brewer, N. T. P., Reiter, P. L. P., Gottlieb, S. L. M., & Smith, J. S. P. The Carolina HPV immunization attitudes and beliefs scale (CHIAS): Scale development and associations with intentions to vaccinate. *Sexually Transmitted Diseases, in press*.

95 Das, A., Madhwapathi, V., Davies, P., Brown, G., Dearnley, E., Spencer, A. et al. Knowledge and acceptability of the HPV vaccine by school children and their parents in Birmingham. *Vaccine, 28(6):*1440-1446.

96 Bernat, D. H., Harpin, S. B., Eisenberg, M. E., Bearinger, L. H., & Resnick, M. D. (2009). Parental support for the human papillomavirus vaccine. *Journal of Adolescent Health, 45,* 525-527.

97 Morison, L. A., Cozzolino, P. J., & Orbell, S. (2010). Temporal perspective and parental intention to accept the human papillomavirus vaccination for their daughter. *British Journal of Health Psychology, 15,* 151-165.

98 Barnack, J. L., Reddy, D. M., & Swain, C. (2001). Predictors of parents' willingness to vaccinate for human papillomavirus and physicians' intentions to recommend the vaccine. *Women's Health Issues, 20,* 28-34.

99 Fang, C. Y., Coups, E. J., & Heckman, C. J. (2010). Behavioral correlates of HPV vaccine acceptability in the 2007 Health Information National Trends Survey (HINTS). *Cancer Epidemiology Biomarkers & Prevention, 19,* 319-326.

100 Cox, D. S., Cox, A. D., Sturm, L., & Zimet, G. (2010). Behavioral interventions to increase HPV vaccination acceptability among mothers of young girls. *Health Psychology, 29,* 29-39.

101 Gamble, H. L., Klosky, J. L., Parra, G. R., & Randolph, M. E. (2009). Factors influencing familial decision-making regarding human papillomavirus vaccination. *Journal of Pediatric Psychology, in press*.

102 Roberts, S. A., Brabin, L., Stretch, R., Baxter, D., Elton, P., Kitchener, H. et al. (2010). Human papillomavirus vaccination and social inequality: results from a prospective cohort study. *Epidemiology and Infection,* 1-6.

103 Ogilvie, G., Anderson, M., Marra, F., McNeil, S., Pielak, K., Dawar, M. et al. (2010). A population-based evaluation of a publicly funded, school-based HPV vaccine program in British Columbia, Canada: parental factors associated with HPV vaccine receipt. *PLoS Med, 7,* e1000270.

105 Borras, E., Dominguez, A., Fuentes, M., Batalla, J., Cardenosa, N., & Plasencia, A. (2009). Parental knowledge of paediatric vaccination. *BMC Public Health, 9:154*.

106 Danis, K., Georgakopoulou, T., Stavrou, T., Laggas, D., & Panagiotopoulos, T. (2010). Socioeconomic factors play a more important role in childhood vaccination coverage than parental perceptions: a cross-sectional study in Greece. *Vaccine, 28(7)*:1861-1869.

107 Freed, G. L., Clark, S. J., Butchart, A. T., Singer, D. C., & Davis, M. M. (2010). Parental vaccine safety concerns in 2009. *Pediatrics, 125(4)*:654-659.

108 Fu, L. Y., Cowan, N., McLaren, R., Engstrom, R., & Teach, S. J. (2009). Spatial accessibility to providers and vaccination compliance among children with medicaid. *Pediatrics.124(6)*:1579-1586.

109 Luman, E. T. & Chu, S. Y. (2009). When and why children fall behind with vaccinations: missed visits and missed opportunities at milestone ages. *American Journal of Preventive Medicine, 36,* 105-111.

110 Luthy, K. E., Beckstrand, R. L., & Callister, L. C. (2010). Parental hesitation in immunizing children in Utah. *Public Health Nursing, 27(1):*25-31.

111 Mortensen, G. L. (2010). Drivers and barriers to acceptance of human-papillomavirus vaccination among young women: a qualitative and quantitative study. *Bmc Public Health, 10*.

112 Taddio, A., Chambers, C. T., Halperin, S. A., Ipp, M., Lockett, D., Rieder, M. J. et al. (2009). Inadequate pain management during routine childhood immunizations: the nerve of it. *Clinical Therapeutics.31 Suppl 2*:S152-167.

113 Theeten, H., Vandermeulen, C., Roelants, M., Hoppenbrouwers, K., Depoorter, A. M., & Van, D. P. (2009). Coverage of recommended vaccines in children at 7-8 years of age in Flanders, Belgium. *Acta Paediatrica.98(8)*:1307-1312.

114 Womack, J. M. (2010). Safety and adherence: issues that hinder childhood vaccinations. *JAAPA.23(1)*:42-7.

APPENDIX 3- EXAMPLE EXTRACTION FORM (CONTINUED FOR ID 3 ON FOLLOWING PAGE)

General			**Methods**								
			Design				**Measures**				
ID	**Author and title**	**Year**	**Definition of non-receipt**	**Vaccine of interest**	**Powered to detect effect size**	**Prospective study?**	**Validated measure used**	**Measure of vaccination receipt**	**Piloted measure**	**Measure of intention**	**Qualitative quality assessment**
					small, medium, large	Y/N	Some, all, none/not reported		Y/N		
3	Allison et al. School-based health centers: Improving access and quality of care for low-income adolescents	2007	If tetanus booster needed, receipt = booster during study period	Tetanus	Small	N	None	Chart review	N	N/A	N/A

Example extraction form continued…

Population								
Gender	**Average age of child/adolescent**	**Parent or adolescent**	**N**	**Recruitment site**	**>50% response rate**	**Country**	**Mean SES**	**Most common ethnic group**
M/F/Both		P(mother/father)/A/Both			Y/N			
Both	14-17 year olds	A	1715	Attended a health service in Denver in 20 months before study period and registered in school	Not reported	USA	Not reported	Latino

Example extraction form continued…

Results				**Quality score**
Factors examined	**Univariate associations with non-receipt/non-intention**	**Non-significant findings reported**	**Qualitative reasons for receipt/intention**	
Attendance at a school based clinic or other clinic	Attendance at a non-school based clinic			2

APPENDIX 4 – ANALYSIS FROM CHAPTER 4

EXAMPLE OF THE FRAMEWORK ANALYSIS

Risk compensation

Article	Article type	Newspaper type	Political stance	Readership	In month with major news event?	Above median percentage of risk compensation words?	Encourage negative sexual outcomes	Reason why it will cause these negative outcomes
The Sun 21-06-2007	News	Tabloid	Labour	White van man	HPV vaccine to be given to schoolgirls	N	But some campaigners and religious groups claim the vaccine could encourage girls to have unprotected sex.	
The Times 21-06-2007	News	Tabloid	Labour	White van man	HPV vaccine to be given to schoolgirls	Y	Some campaigners and religious groups have expressed concerns that providing a jab to children to protect against the sexually transmitted infection may encourage promiscuity	
Daily Telegraph 20-06-2007	News	Broadsheet	Labour	Businessmen and professionals	HPV vaccine to be given to schoolgirls	N		

OTHER THEMES AND SUB-THEMES FROM FRAMEWORK ANALYSIS

Sex education

The curriculum

Vaccination education

Effects of sex education

Concerns about age

Why young people are being vaccinated: sex at a young age

Why young people are being vaccinated: puberty at a young age

Why young people are being vaccinated: HPV infection levels and age

Decisions about what age to vaccinate

Too young to vaccinate

Benefits

Physical benefits

How long before benefits will be seen

Psychological benefits

Children

Responsibility for decisions

Discussions with friends

Parents broaching the topic of vaccination with children

Dislike of injections

Consent

Compulsory vaccination

Parental consent

How the vaccine is labelled

Sex

Cancer

General protection

Parents' vaccination decisions

Concerns

Vaccination discussions

Emotional responses

Critics of the vaccine

Who the critics are

Critics are unaware of the realities of bringing up children

Irresponsible to be a critic

Concerns

Side effects

Vaccines generally

Sex in society

Behaviours relating to sex

Societal norms

APPENDIX 5 - PUBLICATION FROM CHAPTER 4

Journal of Health Communication, 15:205–217, 2010

ISSN: 1081-0730 print/1087-0415 online
DOI: 10.1080/10810730903528066

Routledge
Taylor & Francis Group

Passport to Promiscuity or Lifesaver: Press Coverage of HPV Vaccination and Risky Sexual Behavior

ALICE FORSTER AND JANE WARDLE

Cancer Research UK Health Behaviour Research Centre, University College London, London, United Kingdom

JUDITH STEPHENSON

Centre for Sexual Health and HIV Research, University College London, London, United Kingdom

JO WALLER

Cancer Research UK Health Behaviour Research Centre, University College London, London, United Kingdom

A significant minority of parents are concerned about adolescents engaging in risky sexual behavior following human papillomavirus (HPV) vaccination. The way the HPV vaccine is reported in the media has the potential to influence public understanding and vaccination decisions. The present study examined the content of articles published between 2003 and 2008 in British national newspapers that addressed the issue of adolescents engaging in risky sexual behavior following HPV vaccination. We used mixed methods to analyze 92 articles in which the issue was mentioned. Qualitative framework analysis highlighted three main types of discussion: news stories proposing that adolescents will engage in risky sexual behavior following HPV vaccination, counterarguments insisting that adolescents will not engage in risky sexual behavior after HPV vaccination, and parents' views of the issue of risky sexual behavior. The results indicated that newspapers provide parents with broadly positive descriptive norms about vaccination; however, the issue that adolescents will engage in risky sexual behaviors following HPV vaccination is regularly discussed in the national press and has the potential to increase parents' concerns about vaccination.

The development of the first vaccine to prevent cancer has captured the imagination of scientists and the public alike. It is a "good news" story of scientists making progress against one of the world's most dreaded diseases, and opens up new hope for future cancer prevention. The vaccine protects against two cancer-causing types

Two of the authors (Jane Wardle and Jo Waller) are supported by Cancer Research UK, Alice Forster is supported by a UCL Medical School studentship, and Judith Stephenson is employed by University College London. We have also received funding or honoraria from Sanofi Pasteur MSD and GSK Biologicals, both of whom manufacture HPV vaccines.

Address correspondence to Dr. Jo Waller, Cancer Research UK Health Behaviour Research Centre, Department of Epidemiology and Public Health, University College London, Gower Street, London, WC1E 6BT, UK. E-mail: j.waller@ucl.ac.uk

of human papillomavirus (HPV), a family of viruses responsible for many anogenital cancers, most notably cancer of the cervix (Walboomers et al., 1999). About a thousand women a year die of cervical cancer in the United Kingdom (Cancer Research UK, 2007), and an immunization program is now being rolled out that is estimated to protect against 70% of these cancers (Paavonen et al., 2007). In the United Kingdom, the three-dose immunization currently is offered to all 12–13-year-old girls. Similar programs are being set up in other countries around the world. High uptake of the vaccine will maximize the number of girls protected from future disease. This will be achieved only if the program is acceptable to the majority of parents, because, under the present system, parental consent is required for participation in the school immunization program.[1]

Experience in the United Kingdom of other vaccines, notably those against pertussis and measles, mumps, and rubella (MMR), shows that media reporting of vaccine safety issues can have a profound impact on public perceptions and vaccine uptake (Griffith, 1981; Hackett, 2008). For HPV vaccination, the sexually transmitted nature of the infection gives rise to additional sensitivities, and there is a danger that the HPV vaccine will become the subject of controversy; consequently, uptake could be compromised.

Studies of parents' acceptance of the HPV vaccine show that a significant minority of parents are likely to oppose it. In the United Kingdom, when parents have been asked whether they would hypothetically consent to their daughter receiving the vaccine, acceptance ranges from 75% to 81% (Brabin, Roberts, Farzaneh, & Kitchener, 2006; Marlow, Waller, & Wardle, 2007a) and a feasibility study in which parents provided consent to actual vaccination achieved 71% uptake for dose one and 68% uptake for dose two (Brabin et al., 2008).

Both within and outside the United Kingdom, parental concerns about the safety of the vaccine have been found to predict hypothetical acceptance (e.g., Gillespie, Banas, Tang, Worley, & Rome, 2008; Marlow et al., 2007a), as has believing a child is not at risk of contracting HPV (e.g., Dempsey, Zimet, Davis, & Koutsky, 2005; Fazekas, Brewer, & Smith, 2008; Woodhall et al., 2007). Additionally, up to 20% of parents report being concerned that the vaccine may affect young women's sexual behavior (e.g., Brabin et al., 2008; Ogilvie et al., 2007), and this belief is more prevalent in Asian and Black parents than in White parents (Marlow, Wardle, Forster, & Waller, 2009). This concern centers on the notion that the vaccine could give adolescents a false sense of protection that will result in "sexual disinhibition," or engaging in more risky sexual behavior. Parents who endorse this belief have been found to be less accepting of the vaccine (Marlow et al., 2007a; Ogilvie et al., 2007; Woodhall et al., 2007).

Because the HPV vaccine only recently has been introduced, there is no empirical evidence about its impact on sexual behavior, but testable hypotheses derived from risk compensation theory (Adams, 1985; Wilde, 1976) suggest that changes

[1]Adolescents also may play a role in deciding to participate in the HPV immunization program. Individuals under the age of 16 in England and Wales have the legal right to confidential health care without parental consent if they are considered competent to understand the information given to them, including the risks and alternatives, and make a balanced decision, sometimes termed "Gillick competence" (Gillick v West Norfolk and Wisbech Area Health Authority and Department of Health and Social Security, 1983). Also, a significant proportion of parents report that their consent to their daughter's participation in the program will be based on a joint parent–daughter decision (Brabin, Roberts, & Kitchener, 2007).

in behavior could occur. In its simplest form, the theory suggests that in any given domain, individuals have a level of risk that they are willing to tolerate. Individuals attempt to maximize the benefits and minimize the personal risks of engaging in an activity. Perceiving a personal risk to have changed results in an adjustment of activity to restore the benefits–risk balance. On the basis of risk compensation theory, a perceived reduction in sexually transmitted infection (STI) risk following HPV vaccination may lead to young women engaging in more high-risk sexual behavior. There is evidence from studies of other vaccinations that risk compensation might occur. Brewer, Cuite, Herrington, and Weinstein (2007) studied Lyme disease protective behaviors following Lyme disease vaccination. They found a reduction in two of five behaviors (using tick repellent and wearing light-colored clothing) in their vaccinated group. Similarly, Bartholow and colleagues (2005) studied male participants in an HIV vaccine trial who reported having sex with men. Those who believed that they were allocated to the experimental arm (although they were blind to their allocation) reported an increase in their instances of unprotected anal sex.

No studies have examined risk compensation theory in relation to HPV vaccination, and its relevance to HPV may be limited as there is no evidence that girls currently engage in safe sexual behaviors to prevent HPV infection. Prior to the development of the vaccine, the percentage of young women who knew that HPV was the cause of cervical cancer was reported to be between 8% and 68% (Klug, Hukelmann, & Blettner, 2008). Also, fear of pregnancy or other STIs (that the vaccine does not protect against) are commonly reported reasons for remaining abstinent in young women (Blinn-Pike, 1999; Morrison-Beedy, Carey, Cote-Arsenault, Seibold-Simpson, & Robinson, 2008). The concern that HPV vaccination will impact on sexual behavior in accordance with the theory, however, has received attention in the national press and is the focus of the present study.

The media is a popular source of information about HPV (Pitts, Dyson, Rosenthal, & Garland, 2007) and can affect perception of health issues (Lupton, 1998). This is especially evident in the significant role that the media played in shaping the MMR vaccine controversy (Hackett, 2008). In the United Kingdom, the development, licensing, and introduction of the HPV vaccine has received a great deal of media coverage, but the content of this coverage has not been rigorously assessed. Quilliam (2006) reviewed 11 HPV vaccination stories in British newspapers and British news websites after the announcement that the vaccine had been developed. Ten of these reports were predominantly positive, and stories that criticized the vaccine tended to have only a single sentence of negative commentary. Only one article was completely disparaging. Systematic analyses of newspaper and television news stories about HPV in the U.S. media have found that information provided about HPV was not always accurate, and it often failed to include the basic facts that women generally want to know, such as information about transmission (Anhang, Stryker, Wright, & Goldie, 2004; Calloway, Jorgensen, Saraiya, & Tsui, 2006). One analysis of HPV vaccination videos posted on the Internet found that the content mainly was positive (Ache & Wallace, 2008), although a proportion of these are likely to have been funded or created by the pharmaceutical industry.

Media coverage of the HPV vaccine is likely to play a key role in raising public awareness of the immunization program and shaping social norms around vaccination behavior. It may influence public discourse about increased sexual behavior following vaccination and thus influence parental beliefs about this issue. The present study examined U.K. newspaper stories about the HPV vaccine, and focused

specifically on stories discussing the issue of adolescents engaging in risky sexual behavior following HPV vaccination.

Materials and Methods

We carried out a retrospective, mixed-methods study examining newspaper stories relating to the HPV vaccine. We used the electronic database NexisUK to obtain the stories for analysis (Reed Elsevier Ltd., 2008). NexisUK is an online database of articles from more than 12,500 international, national, and regional news sources worldwide. We searched the most highly read daily ($N = 11$) and Sunday ($N = 10$) newspapers in the United Kingdom (based on Guardian circulation figures from December 2007; Guardian News and Media Limited, 2008a, 2008b [Table 1]); over a 5-year period (February 2003 through February 2008). The search terms included "HPV OR human papillomavirus"; "cervical AND cancer"; "STD OR sexually transmitted disease AND vaccine," as well as common misspellings of these terms.

Table 1. Newspapers evaluated in the study

Newspaper name grouped by newspaper type	No. of included articles	No. of articles that were predominantly...		
		Supportive	Neutral	Opposed
Tabloid newspapers				
The Sun	4	1	3	0
The Mirror	4	1	3	0
The Daily Star	0	0	0	0
The Daily Record	3	2	1	0
News of the World	1	1	0	0
Sunday Mirror	1	0	1	0
The People	0	0	0	0
The Daily Star Sunday	0	0	0	0
Middle-market newspapers				
The Daily Mail	26	4	21	1
The Daily Express	5	1	4	0
The Sunday Mail	0	0	0	0
The Sunday Express	2	0	2	2
Broadsheet newspapers				
The Daily Telegraph	13	3	8	2
The Times	7	4	3	0
The Financial Times	7	1	5	1
The Guardian	7	2	5	0
The Independent	5	1	4	0
The Sunday Times	3	0	3	0
The Sunday Telegraph	1	0	1	0
The Observer	2	0	2	0
The Independent on Sunday	1	0	1	0

After reading the stories identified by the search to gain familiarity with them, inclusion and exclusion criteria were applied that had been developed through discussion. All stories that addressed the issue of adolescents engaging in risky sexual behavior following HPV vaccination were included. Stories were excluded if they were duplicates, focused on the finances of pharmaceutical companies, or if fewer than 100 words of the story related to the HPV vaccine. One story was removed because it was a biography of an immunologist. We included all article types (e.g., letters, editorials) because we felt that a more comprehensive understanding of the topic could be achieved by accessing both news and comment. The first author applied the inclusion criteria to all the articles identified, and a second author read 20% of the stories to validate this process. The kappa was good (.73; Cohen, 1960), and percentage agreement was high (92%).

Analysis

For each article, the date of publication, type of newspaper, and type of article were noted. For the quantitative analysis we plotted the number of articles published per month, established the predominant topic of each story, and summed the number of times each topic arose overall. For the qualitative content analysis, we developed a systematic and flexible matrix-based coding instrument by organizing sections of the articles into categories (Ritchie & Spencer, 2000). We identified similarities between initial categories; these categories were grouped together and labeled. We then revised the framework to ensure that it was appropriate for the data. We performed a descriptive analysis of the framework. We also rated the tone of each article as either "supportive" (generally encouraging of the vaccine), "neutral" (stating no or mixed opinions about the vaccine), or "opposed" (generally critical of the vaccine). This analysis was conducted by the first author in close discussion with the other authors.

Results

Characteristics of the Articles Included

The initial search identified 539 stories: 81 were duplicates, 35 were financial articles, 84 contained fewer than 100 words about the HPV vaccine, one was a biography of an immunologist, and 120 did not mention the HPV vaccine. Of the remaining 218 articles, 42% ($n = 92$) referred to risky sexual behavior (see Figure 1 for a plot of the annual figures). Consequently, we included these 92 stories in the main analysis (Table 1). These came from daily and Sunday papers and from a mixture of "tabloid" newspapers (focus on sensational stories and gossip), "middle-market" newspapers (entertainment and some serious news coverage), and "broadsheet" newspapers (more intellectual and in-depth in content).

Quantitative Analysis

The notion of increased risky sexual behavior following HPV vaccination was not mentioned prior to December 2004; however, following this date, the number of stories published per year increased steadily (Figure 1; data for 2008 are not shown as analysis was conducted at the start of 2008). Figure 1 shows five peaks in the

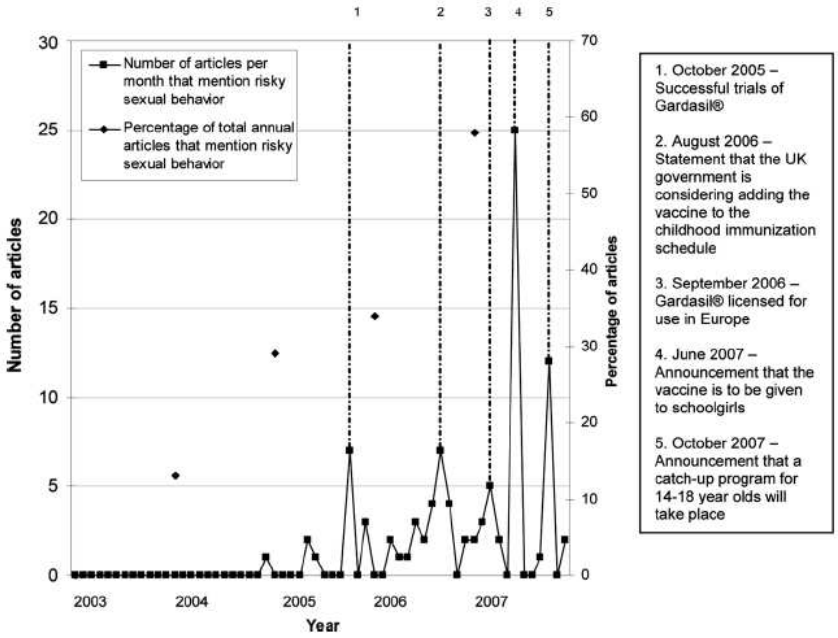


Figure 1. Number of stories that mention adolescents engaging in risky sexual behavior following HPV vaccination and percentage of total annual articles that mention risky sexual behavior.

number of articles published per month, corresponding to vaccine-related events: October 2005 – Successful trials of Gardasil® (a brand of HPV vaccine); August 2006 – Statement that the U.K. government is considering adding the vaccine to the childhood immunization program; September 2006 – Gardasil® licensed for use in Europe; June 2007 – Announcement that the vaccine is to be given to schoolgirls in the United Kingdom; October 2007 – Announcement that a "catch-up" program for 14–18-year-olds will take place in the United Kingdom.

The proportion of articles about the HPV vaccine (total $n = 218$) mentioning the idea of adolescents engaging in risky sexual behaviors following vaccination increased over time, from 0% in 2003 to 13% in 2004, 29% in 2005, 34% in 2006, and 58% in 2007. In articles that mentioned the HPV vaccine, sexual behavior increasingly was discussed during 2 of the months when vaccine-related events occurred. In August 2006, when the U.K. government announced that it was considering adding HPV to the childhood immunization program, 100% of stories about the vaccine mentioned sexual behavior. This figure was 81% for articles published in June 2007 when the government confirmed that the vaccine would be given to schoolgirls. Only 5% of the 92 articles included in our final analysis, however, were predominantly opposed toward the vaccine (72% were neutral and 23% supportive). As a proportion of the 92 articles mentioning risky sexual behavior, the number that were predominantly positive in tone decreased from 2005–2007, whereas the number of neutral articles fluctuated but remained fairly high. Predominantly negative articles were published only in 2007 when the school immunization program was announced.

The Daily Mail and *The Times* published the highest number of predominantly supportive articles (both $n=4$; Table 1) and *The Sunday Express* and *The Daily Telegraph* published the highest number of predominantly negative articles (both $n=2$). The issue of girls engaging in risky sexual behavior following vaccination usually was considered briefly and was the predominant theme of only 14% ($n=13$) of the stories. Most stories focused on explaining the vaccine and cervical cancer (35%) or the introduction of the vaccine (34%). Other themes arising from the stories included the pharmaceutical industry (4%), vaccination safety (3%), vaccination schemes in other countries (2%), STI rates (2%), calls to vaccinate boys (1%), the NHS (1%), personal experiences of cancer (1%), and sex before marriage (1%).

Qualitative Analysis

Discussions of adolescent sexual behavior following HPV vaccination fell into three broad groups, although often the three types of discussion occurred within the same news story:

- News stories proposing that adolescents will engage in risky sexual behavior following HPV vaccination (mentioned in 60 of 92 articles).
- Counterarguments that adolescents will not engage in risky sexual behavior after HPV vaccination (mentioned in 23 of 92 articles).
- Parents' view of adolescents engaging in risky sexual behavior following vaccination (mentioned in 12 of 92 articles).

News Stories Proposing That Adolescents Will Engage in Risky Sexual Behavior

Just under two-thirds of all of the stories (56/92) provided some suggestion that the vaccine might encourage adolescents to engage in risky sexual behaviors, mentioning negative outcomes including teenage pregnancy, infertility, reduced condom use, increased STI rates, more promiscuity, and sex at a younger age. These claims were never substantiated with objective evidence. "Groups" rather than individuals were referenced as criticizing the vaccine on these grounds, and only four individuals were named and quoted: Stephen Green of *Christian Voice* said, "It is also irresponsible and will raise promiscuity, teenage pregnancy and, worst of all, infertility" (*The Daily Mail*, December 28, 2007); "Critics said the jab, designed to be given before girls become sexually active, may promote sexual promiscuity" (*The Mirror*, June 21, 2007); "Conservative groups, including the influential Family Research Council (FRC), voiced strong concerns that immunising young girls against HPV may lead to sexual promiscuity" (*The Daily Mail*, April 16, 2007).

A few stories (4/92) suggested why adolescents' sexual behavior might change, such as girls believing that they are protected following vaccination and having reduced incentives to practice safer sex. One article merely stated that the vaccine will "trigger" unsafe sexual behavior, without specific explanations.

Counterarguments

Counterarguments to the suggestion that adolescents will engage in risky sexual behaviors after HPV vaccination were not common (23/92), but several claims were made. Often these claims were made in articles that also had suggested that risky sexual behavior will occur (15/23).

A popular rebuttal (7/92) was that the vaccine does not protect against other problems related to unprotected sex and therefore there should be no change in sexual behavior. Individual doctors or unspecified "supporters of the vaccine" were quoted as being proponents of such views. Some of these articles (2/92) suggested that parents will attempt to reduce the likelihood of their daughters engaging in increased risky sexual behavior by reminding them about pregnancy. Others (3/92) suggested that schoolgirls are already apprehensive about other STIs, and this would prevent them from adopting more high-risk sexual behavior.

Some stories (7/92) emphasized the lack of any evidence to support the argument that adolescents will engage in risky sexual behaviors following vaccination. Two of these stories quoted charities with an interest in the successful implementation of the immunization program as proponents of such views, such as Cancer Research UK. Spokespersons were quoted as stating that there was no evidence to support the critics' claims and provided comparisons with other vaccines that also are related to sex (such as the rubella vaccine), noting that these vaccines did not cause any adverse effects on sexual behavior. In addition, one feature article presented evidence suggesting that the vaccine will have the opposite effect on sexual behavior due to the positive consequences of sex education.

Seven articles vaguely proposed that adolescents will not engage in risky sexual behaviors, but they did not back-up these claims. The idea that adolescents will increase their risky sexual health behavior after receiving the HPV vaccine was simply rejected, and named experts were quoted in four of these articles: Professor Henry Kitchener "dismissed protests that such a vaccine programme would encourage sexual promiscuity" (*The Daily Mail,* March 31, 2006).

Parents' Views

Twelve articles, all published since June 2006, considered parents' views about the effect of the HPV vaccine on adolescents' sexual behavior. Two of these stories stated that parents "in general" were concerned about adolescent sexual behaviors following vaccination: "The move will be controversial with some parents, who fear the jabs will encourage unprotected sex" (*The Observer*, December 24, 2007).

Most articles, however, reported positive attitudes among parents (10/92). Most of these stories (8/10) provided evidence from specific studies conducted by Cancer Research UK (e.g., Marlow et al., 2007a) and researchers at the University of Manchester (e.g., Brabin et al., 2006) and gave numerical findings. These stories generally were printed in broadsheet newspapers, and probably corresponded to press releases relating to the publication of the specific research findings: "In January this year, Cancer Research UK found that . . . only 12 per cent (of mothers) thought it might encourage promiscuous behaviour" (*The Daily Telegraph,* October 27, 2007).

One news story described the opinions of individual mothers (*The Daily Mail*, June 22, 2007). Some of these mothers acknowledged the sexually transmitted nature of HPV, but they stated that they did not believe that vaccination would result in risky sexual behavior in their daughters. These women's views were countered by other aspects of the article, however, that asserted that "mothers" (in general) were expressing "grave concerns" about the vaccine. Additionally, one mother was quoted as being "realistic" in believing that the vaccine will raise issues surrounding sex when her daughter is older.

Discussion

As the new HPV immunization program for the prevention of cervical cancer is implemented across the United Kingdom, the media are likely to play an important role in shaping public debate about the vaccine, in particular, whether they focus on the issue that the vaccine might have an adverse impact on adolescent sexual behavior. In the present study, we examined U.K. national newspaper stories addressing this issue and assessed the types of views proposed, as well as examined the content of the arguments. Media coverage of the vaccine has grown hugely since the announcement of its development, and the issue of adolescents engaging in risky sexual behaviors following vaccination has been a minor, but increasing, theme.

Most of the articles we examined were neutrally disposed toward the vaccine, and only a minority (42%) of articles identified by our original search considered the issue of adolescents engaging in risky sexual behaviors following vaccination. Although over time the issue increasingly was being discussed in articles about the HPV vaccine, usually it was covered briefly and, where endorsed, this often was based on the opinion of unspecified "opposition groups." Articles that were predominantly negative in tone were published when the U.K. government announced that the HPV vaccine was to be introduced into the childhood immunization program, and it was in these months that the percentage of articles mentioning risky sexual behavior as a proportion of all articles discussing the vaccine was highest (80%–100%). The number of articles that were predominantly positive in tone decreased over time, but this is likely to be due to the initial excitement surrounding the development of a cancer-preventing vaccine subsiding. Articles were most likely to be neutral in tone, and over a quarter reported a variety of counterarguments, a small number of which were supported by named "experts." Many of these discussions were presented alongside arguments suggesting that behavior change will occur.

It seems that most parents who read newspapers will be exposed to opposition toward vaccinating school girls and to the idea that the HPV vaccine could encourage risky sexual behavior. Most articles were neutral toward the vaccine, however, and counterarguments also were provided though they were dependent on scientific expertise rather than knowledge of parental concerns. These findings are consistent with recent research that found British news reporting about the vaccine mainly to be positive (Quilliam, 2006). The qualitative differences between the arguments might affect the extent to which parents are influenced by them. Discourse in the articles opposing the immunization program often used emotional language, citing individuals from organizations who claim to be protecting the best interests of children, whereas supporting arguments were more rational and endorsed by science. It is possible that parents who lack trust in the government and science may be more inclined to agree with those who oppose the immunization program. Trust in the government has been found to predict HPV vaccine acceptability (Marlow, Waller, & Wardle, 2007b) and has yet to fully recover from the MMR debacle. It may therefore be beneficial for communication interventions to use information about the HPV vaccine as a way of trying to rebuild parents' trust in immunization more generally.

By citing statistics about "other parents," the articles we analyzed exposed their readers to normative beliefs. Descriptive norms are highly associated with intention to perform health-related behaviors (Rivis & Sheeran, 2003), and intentions in turn

relate to actual behavior (Conner & Sparks, 2005). With this in mind, news stories that included statistics stating that most parents are not concerned about adolescent sexual behavior following vaccination may have decreased the number of readers themselves worrying about this issue; consequently, more parents may intend for their daughter to receive the vaccine. These stories were published infrequently, however, and most appeared in broadsheet newspapers, whose readers are more likely to be from higher social classes than readers of tabloid papers (Newspaper Marketing Agency, 2008). Thus individuals from lower social classes are less likely to have been exposed to these normative beliefs. Future research should examine parental reactions to media representations of the HPV vaccine and adolescent risky sexual behaviors to objectively elucidate how current portrayals affect parents.

Few of the arguments on either side of the debate were substantiated with any evidence. There is currently no empirical evidence about the impact of the immunization program on sexual behavior, but our analysis illustrates that critics are concerned by the possibility that sexual behavior may change. Following the introduction of the vaccine, it will be essential to monitor adolescent behavior and STI levels, although establishing cause and effect will prove complex. Additionally, parents need to be armed with communication tools to help them discuss with their daughters the HPV vaccine and sex to ensure that they understand that safe sexual behaviors are still necessary to prevent other STIs and pregnancy.

As evidence for behavior changes will not be available until sometime after the vaccination has been introduced, a vital role for public health communicators is to ensure that fear of adolescents engaging in risky sexual behaviors does not become a barrier to parents consenting to vaccination. While the possible impact of the vaccine on sexual behavior is unknown, its benefits in terms of reduction of cancer risk are proven. Additionally, research should focus on ways to minimize any possible negative changes in sexual behavior. According to risk compensation theory, communication interventions can achieve this by increasing an individual's perception of risk (e.g., emphasizing potential losses resulting from risky sexual behavior; Kahneman & Tversky, 1979) or decreasing their target level of risk (e.g., rewarding condom use; Wilde, 2002). Individuals managing the promotion of the HPV vaccine should ensure that all stakeholders can access appropriate information and aid informed decision making.

This study provides the first systematic analysis of media coverage of risky sexual behavior and HPV vaccination in the United Kingdom, examining a large number of news stories over an extended period of time. The framework analysis was conducted rigorously, and the newspaper search was thorough; the NexisUK database is as accurate as a hand search of papers (Wells, Marshall, Crawley, & Dickersin, 2001). By excluding articles in local/regional publications and examining national newspapers only, we were able to focus on the types of discussions that large sections of the public are being exposed to, regardless of geographical location. The argument that adolescents will engage in risky sexual behavior following vaccination was regularly, but briefly, discussed in most of the papers. The articles covered both sides of the argument, however, allowing parents the opportunity to form opinions. Arguments against the view that HPV vaccination will result in adolescents engaging in risky sexual behavior were more varied and better elaborated than those supporting the argument, but may have less emotive appeal. Parents are exposed to the experiences of others, and our analyses indicate that most reports say that parents are not unduly concerned about adolescent risky sexual behavior

following vaccination. Nonetheless, the idea that adolescents will increase their risky sexual behavior following vaccination is being consistently proposed in the national press and has the potential to negatively affect parents' attitudes toward vaccination. Interventions must be in place to aid informed decision making, to rebuild trust in immunization programs, and to ensure that parents are equipped with the communication skills to discuss with their daughters the HPV vaccination and sex.

References

Ache, K. A., & Wallace, L. S. (2008). Human papillomavirus vaccination coverage on YouTube. *American Journal of Preventive Medicine*, *53*, 389–392.

Adams, J. G. U. (1985). *Risk and freedom: The record of road safety regulation*. London: Transport Publishing Projects.

Anhang, R., Stryker, J. E., Wright, T. C., & Goldie, S. J. (2004). News media coverage of human papillomavirus. *Cancer*, *100*, 308–314.

Bartholow, B. N., Buchbinder, S., Celum, C., Goli, V., Koblin, B., Para, M., et al. (2005). HIV sexual risk behavior over 36 months of follow-up in the world's first HIV vaccine efficacy trial. *Journal of Acquired Immune Deficiency Syndrome*, *39*, 90–101.

Blinn-Pike, L. (1999). Why abstinent adolescents report they have not had sex: Understanding sexually resilient youth. *Family Relations*, *48*, 295–301.

Brabin, L., Roberts, S. A., Farzaneh, F., & Kitchener, H. C. (2006). Future acceptance of adolescent human papillomavirus vaccination: A survey of parental attitudes. *Vaccine*, *24*, 3087–3094.

Brabin, L., Roberts, S. A., & Kitchener, H. C. (2007). A semi-qualitative study of attitudes to vaccinating adolescents against human papillomavirus without parental consent. *BioMed Central: Public Health*, *7*.

Brabin, L., Roberts, S. A., Stretch, R., Baxter, D., Chambers, G., Kitchener, H. C., et al. (2008). Uptake of first two doses of human papillomavirus vaccine by adolescent schoolgirls in Manchester: Prospective cohort study. *British Medical Journal*, *336*, 1056–1058.

Brewer, N. T., Cuite, C. L., Herrington, J. E., & Weinstein, N. D. (2007). Risk compensation and vaccination: Can getting vaccinated cause people to engage in risky behaviors? *Annals of Behavioral Medicine*, *34*, 95–99.

Calloway, C., Jorgensen, C. M., Saraiya, M., & Tsui, J. (2006). A content analysis of news coverage of the HPV vaccine by U.S. newspapers, January 2002–June 2005. *Journal of Women's Health*, *15*, 803–809.

Cancer Research UK. (2007). *UK cervical cancer statistics*. Retrieved January 22, 2010, from http://info.cancerresearchuk.org/cancerstats/types/cervix/?a=5441

Cohen, J. (1960). A coefficient of agreement for nominal scales. *Educational and Psychological Measurement*, *20*, 37–46.

Conner, M., & Sparks, P. (2005). Theory of planned behaviour and health behaviour. In M. Conner & P. Norman (Eds.), *Predicting health behaviour* (2nd ed., pp. 170–223). Maidenhead, UK: Open University Press.

Dempsey, A. F., Zimet, G. D., Davis, R. L., & Koutsky, L. (2005). Factors that are associated with parental acceptance of human papillomavirus vaccines: A randomized intervention study of written information about HPV. *Pediatrics*, *117*, 1486–1493.

Fazekas, K. I., Brewer, N. T., & Smith, J. A. (2008). HPV vaccine acceptability in a rural southern area. *Journal of Women's Health*, *17*, 1–10.

Gillespie, L., Banas, D., Tang, A. S., Worley, S., & Rome, E. S. (2008). Acceptability of the HPV vaccine among parents of newborn to ten year old children. *Journal of Pediatric and Adolescent Gynecology*, *21*, 58.

Gillick v West Norfolk and Wisbech Area Health Authority and Department of Health and Social Security. (1983). *3 WLR (QBD)*.

Griffith, A. H. (1981). Medicine and the media—Vaccination against whooping cough. *Journal of Biological Standardization*, *9*, 475–482.

Guardian News and Media Limited (2008a). *National Sunday newspaper circulation—December 2007*. Retrieved January 22, 2010, from http://media.guardian.co.uk/press-publishing/table/0,,2241628,00.html

Guardian News and Media Limited. (2008b). *National daily newspaper circulation December 2007*. Retrieved January 22, 2010, from http://media.guardian.co.uk/presspublishing/table/0,,2241617,00.html.

Hackett, A. J. (2008). Risk, its perception and the media: The MMR controversy. *Community Practitioner*, *81*, 22–25.

Kahneman, D., & Tversky, A. (1979). Prospect theory—Analysis of decision under risk. *Econometrica*, *47*, 263–291.

Klug, S. J., Hukelmann, M., & Blettner, M. (2008). Knowledge about infection with human papillomavirus: A systematic review. *Preventative Medicine*, *46*, 87–98.

Lupton, D. (1998). Medicine and health care in popular media. In A. Brechin, J. Walmsley, J. Katz, & S. Peace (Eds.), *Care matters: concepts, practice and research in health and social care* (pp. 194–207). London: Sage.

Marlow, L. A. V., Waller, J., & Wardle, J. (2007a). Parental attitudes to pre-pubertal HPV vaccination. *Vaccine*, *25*, 1945–1952.

Marlow, L. A. V., Waller, J., & Wardle, J. (2007b). Trust and experience as predictors of HPV vaccine acceptance. *Human Vaccines*, *3*, 171–175.

Marlow, L. A. V., Wardle, J., Forster, A. S., & Waller, J. (2009). Ethnic differences in HPV awareness and vaccine acceptability. *Journal of Epidemiology and Community Health*, *63*, 1010–1015.

Morrison-Beedy, D., Carey, M. P., Cote-Arsenault, D., Seibold-Simpson, S., & Robinson, K. A. (2008). Understanding sexual abstinence in urban adolescent girls. *Jognn-Journal of Obstetric Gynecologic and Neonatal Nursing*, *37*, 185–195.

Newspaper Marketing Agency. (2008). *NMA facts and figures*. Retrieved January 22, 2010, from http://www.nmauk.co.uk/nma/do/live/factsAndFigures?newspaperID=11

Ogilvie, G. S., Remple, V. P., Fawziah, M., Mcneil, S. A., Monika, N., Karen, L. P., et al. (2007). Parental intention to have daughters receive the human papillomavirus vaccine. *Canadian Medical Association Journal*, *177*, 1506–1512.

Paavonen, J., Jenkins, D., Bosch, F. X., Naud, P., Salmeron, J., Wheeler, C. M., et al. (2007). Efficacy of a prophylactic adjuvanted bivalent L1 virus-like-particle vaccine against infection with human papillomavirus types 16 and 18 in young women: An interim analysis of a phase III double-blind, randomised controlled trial. *Lancet*, *369*, 2161–2170.

Pitts, M. K., Dyson, S. J., Rosenthal, D. A., & Garland, S. M. (2007). Knowledge and awareness of human papillomavirus (HPV): Attitudes towards HPV vaccination among a representative sample of women in Victoria, Australia. *Sexual Health*, *4*, 177–180.

Quilliam, S. (2006). Cervical cancer and the human papillomavirus vaccine. *Journal of Family Planning and Reproductive Health Care*, *32*, 119–120.

Reed Elsevier Ltd. (2008). *NexisUK* [Computer software]. London: Reed Elsevier (UK) Ltd.

Ritchie, J., & Spencer, L. (2000). Qualitative data analysis for applied policy research. In A. Bryman & R. G. Burgess (Eds.), *Analyzing qualitative data* (pp. 173–194). London: Routledge.

Rivis, A., & Sheeran, P. (2003). Descriptive norms as an additional predictor in the theory of planned behaviour: A meta-analysis. *Current Psychology*, *22*, 218–233.

Walboomers, J. M. M., Jacobs, M. V., Manos, M. M., Bosch, F. X., Kummer, J. A., Shah, K. V., et al. (1999). Human papillomavirus is a necessary cause of invasive cervical cancer worldwide. *Journal of Pathology*, *189*, 12–19.

Wells, J., Marshall, P., Crawley, B., & Dickersin, K. (2001). Newspaper reporting of screening mammography. *Annals of Internal Medicine*, *135*, 1029–1037.

Wilde, G. J. S. (1976). The risk compensation theory of accident causation and its practical consequences for accident prevention. Presented at *Osterreichische Gesellschaft fur Unfallchirurgie*.

Wilde, G. J. S. (2002). Does risk homoeostasis theory have implications for road safety. *British Medical Journal*, *324*, 1149–1152.

Woodhall, S. C., Lehtinen, M., Verho, T., Huhtala, H., Hokkanen, M., & Kosunen, E. (2007). Anticipated acceptance of HPV vaccination at the baseline of implementation: A survey of parental and adolescent knowledge and attitudes in Finland. *Journal of Adolescent Health*, *40*, 466–469.

APPENDIX 6- MEASURES FOR CHAPTER 5

Q1. Before this interview were you aware of HPV (human papillomavirus)?

Yes

No

Q2. What do you think your chances of getting cervical cancer in the future are?

No chance

Very unlikely

Unlikely

Moderate chance

Likely

Very likely

Certain to happen

Participant information about HPV

Info card 1 - General HPV information

Cervical cancer kills 250,000 women every year worldwide. The total number of women worldwide who currently have cervical cancer is greater than 1.4 million. 500,000 women are diagnosed with cervical cancer each year.

It has recently been established that cervical cancer is caused by certain types (high risk types) of the HPV virus (human papillomavirus).

Most of the time, no symptoms are felt, but, in certain cases (3%), infection becomes persistent and leads to precancerous lesions, which can in turn develop into cervical cancer if not detected and treated on time.

Cervical cancer can take a long time to develop, i.e. up to 15 – 20 years.

Detection of precancerous changes in the cervix which could lead to cervical cancer is currently carried out by means of smear tests in doctor's surgeries and that is why regular examinations are important. However, smear testing is not a perfect means of detection.

In addition to high risk HPV types, low risk HPV types also exist. These low risk HPV types do not lead to cervical cancer but are responsible for genital warts. Although genital warts are not life threatening, they can cause physical and psychological burden.

At some point in time throughout her life, one woman in two gets exposed to the virus. The virus is generally transmitted via skin-to-skin contact, most commonly during sexual activity. The risk starts right from the first sexual encounter. Condoms do not completely protect against the HPV virus, as it is possible for the virus to be transmitted by sexual contact without intercourse.

An HPV test looks for the presence of HPV infection in the cervical cells. In the future, HPV testing may be used alongside smear tests.

There is a vaccine to prevent cervical cancer, which is caused by HPV. The vaccine prevents 70% of cervical cancers. The vaccine can be given to girls and women aged between 10 and 55 years old. The vaccine is given in 3 doses over a 6 month period: dose 1, then dose 2 one month later and dose 3 five months after the second. The vaccine is given in the arm, like most vaccines. Side effects, such as redness and swelling at the site of the injection, are comparable to all widely used vaccines, i.e. mild and temporary.

Q3. How much do you agree or disagree with this statement?: Having the HPV vaccination might make girls more likely to have sex.

Strongly disagree

Disagree

Neither agree nor disagree

Agree

Strongly agree

Q4. How much do you agree or disagree with this statement?: Girls who had the HPV vaccination would be more likely to have unprotected sex.

Strongly disagree

Disagree

Neither agree nor disagree

Agree

Strongly agree

Q5. How much do you agree or disagree with this statement?: Vaccinating young girls against HPV would encourage sexual promiscuity.

Strongly disagree

Disagree

Neither agree nor disagree

Agree

Strongly agree

Q6. I am now going to read out a series of different conditions and I want you to tell me in general, how serious you consider each of the conditions to be. Please answer on this scale from 1 to 10 where 1 means not at all serious and 10 means extremely serious. If you haven't heard of the condition just say so and we'll move on to the next one.

First, HPV (human papillomavirus)?

1 Not at all serious

2

3

4

5

6

7

8

9

10 Extremely serious

Or 'I have not heard of this condition'

Q7. Please think about your daughter's current situation. How willing would you be to get her vaccinated with this vaccine for the prevention of infection with the HPV virus that causes cervical cancer? Please answer on this scale from 1 to 10 where 1 means not at all willing and 10 means extremely willing.

1 Not at all willing

2

3

4

5

6

7

8

9

10 Extremely willing

Q8. Thinking about cervical cancer screening/smear tests, which ONE of the following statements is closest to your situation?

I regularly have cervical cancer screening/smear tests and do not need reminding

I regularly have cervical cancer screening/smear tests but do need reminding

I do not have regular cervical cancer screening/smear tests in spite of reminders to do so

I have never had a cervical cancer screening/smear test

Q9. From this card, to which of these ethnic groups do you consider you belong?

1 White - British

2 White - Irish

3 White - Any other White background (please specify)

4 Mixed - White and Black Caribbean

5 Mixed - White and Black African

6 Mixed - White and Asian

7 Mixed - Any other mixed background (please specify)

8 Asian or Asian British - Indian

9 Asian or Asian British - Pakistani

10 Asian or Asian British - Bangladeshi

11 Asian or Asian British - Any other Asian background (please specify)

12 Black or Black British - Caribbean

13 Black or Black British - African

14 Black or Black British - Any other Black background (please specify)

15 Chinese

95 Any other (please specify)

Q10. Will you please look at this card (card 1) and tell me which group represents your total income from all sources, before deductions for income tax, National Insurance etc.

Q11. Will you please look at this card (card 1) and tell me which group represents your partner's total income from all sources, before deductions for income tax, National Insurance etc.

Q12. Could you please look at the next card (card 1) and give your total income as an annual amount from this card?

Q13. Could you please look at the next card (card 1) and give your partner's total income as an annual amount from this card? *If the participant or participants' partner's income was in group 38 they were asked to identify their income on card 2 also.*

Card 1

WEEKLY		MONTHLY	ANNUAL
1	Up to £9	Up to £42	Up to £519
2	£10 up to £19	£43 up to £85	£520 up to £1,039
3	£20 up to £29	£86 up to £129	£1,040 up to £1,559
4	£30 up to £39	£130 up to £172	£1,560 up to £2,079
5	£40 up to £49	£173 up to £216	£2,080 up to £2,599
6	£50 up to £59	£217 up to £259	£2,600 up to £3,119
7	£60 up to £69	£260 up to £302	£3,120 up to £3,639
8	£70 up to £79	£303 up to £346	£3,640 up to £4,159
9	£80 up to £89	£347 up to £389	£4,160 up to £4,679
10	£90 up to £99	£390 up to £432	£4,680 up to £5,199
11	£100 up to £119	£433 up to £519	£5,200 up to £6,239
12	£120 up to £139	£520 up to £606	£6,240 up to £7,279
13	£140 up to £159	£607 up to £692	£7,280 up to £8,319
14	£160 up to £179	£693 up to £779	£8,320 up to £9,359
15	£180 up to £199	£780 up to £866	£9,360 up to £10,399
16	£200 up to £219	£867 up to £952	£10,400 up to £11,439
17	£220 up to £239	£953 up to £1,039	£11,440 up to £12,479
18	£240 up to £259	£1,040 up to £1,126	£12,480 up to £13,519
19	£260 up to £279	£1,127 up to £1,212	£13,520 up to £14,559
20	£280 up to £299	£1,213 up to £1,299	£14,560 up to £15,599
21	£300 up to £319	£1,300 up to £1,386	£15,600 up to £16,639
22	£320 up to £339	£1,387 up to £1,472	£16,640 up to £17,679
23	£340 up to £359	£1,473 up to £1,559	£17,680 up to £18,719
24	£360 up to £379	£1,560 up to £1,646	£18,720 up to £19,759
25	£380 up to £399	£1,647 up to £1,732	£19,760 up to £20,799
26	£400 up to £449	£1,733 up to £1,949	£20,800 up to £23,399
27	£450 up to £499	£1,950 up to £2,166	£23,400 up to £25,999
28	£500 up to £549	£2,167 up to £2,382	£26,000 up to £28,599
29	£550 up to £599	£2,383 up to £2,599	£28,600 up to £31,199

30	£600 up to £649	£2,600 up to £2,816	£31,200 up to £33,799
31	£650 up to £699	£2,817 up to £3,032	£33,800 up to £36,399
32	£700 up to £749	£3,033 up to £3,249	£36,400 up to £38,999
33	£750 up to £799	£3,250 up to £3,466	£39,000 up to £41,599
34	£800 up to £849	£3,467 up to £3,685	£41,600 up to £44,199
35	£850 up to £899	£3,686 up to £3,899	£44,200 up to £46,799
36	£900 up to £949	£3,900 up to £4,116	£46,800 up to £49,399
37	£950 up to £999	£4,117 up to £4,332	£49,400 up to £51,999
38	£1000 or more	£4,333 or more	£52,000 or more

Card 2

1	£52,000 up to £53,999	17	£120,000 up to £124,999	33	£200,000 up to £209,999
2	£54,000 up to £55,999	18	£125,000 up to £129,999	34	£210,000 up to £219,999
3	£56,000 up to £57,999	19	£130,000 up to £134,999	35	£220,000 up to £229,999
4	£58,000 up to £59,999	20	£135,000 up to £139,999	36	£230,000 up to £239,999
5	£60,000 up to £64,999	21	£140,000 up to £144,999	37	£240,000 up to £249,999
6	£65,000 up to £69,999	22	£145,000 up to £149,999	38	£250,000 up to £259,999
7	£70,000 up to £74,999	23	£150,000 up to £154,999	39	£260,000 up to £269,999
8	£75,000 up to £79,999	24	£155,000 up to £159,999	40	£270,000 up to £279,999
9	£80,000 up to £84,999	25	£160,000 up to £164,999	41	£280,000 up to £289,999
10	£85,000 up to £89,999	26	£165,000 up to £169,999	42	£290,000 up to £299,999
11	£90,000 up to £94,999	27	£170,000 up to £174,999	43	£300,000 up to £319,999
12	£95,000 up to £99,999	28	£175,000 up to £179,999	44	£320,000 up to £339,999
13	£100,000 up to £104,999	29	£180,000 up to £184,999	45	£340,000 up to £359,999
14	£105,000 up to £109,999	30	£185,000 up to £189,999	46	£360,000 up to £379,999
15	£110,000 up to £114,999	31	£190,000 up to £194,999	47	£380,000 up to £399,999
16	£115,000 up to £119,999	32	£195,000 up to £199,999	48	£400,000 or more

Q14: Have you passed any of the examinations on this card?

SECTION 1:

GCSE Grades D-G/Short course GCSE/Vocational GCSE

CSE Grades 2-5

O-level grades D-E or 7-9

Scottish SCE Ordinary Bands D-E

Scottish Standard Grades 4-7

SCOTVEC/SQA National Certificate modules

Scottish School Leaving Certificate – (no grade)

Scottish Access 1-3

Scottish Intermediate 1

SECTION 2:

GCSE Grades A*-C

CSE Grade 1

O-level Grades A-C or 1-6

School Certificate/Matriculation

Scottish SCE Ordinary Bands A-C or Pass

Scottish Standard Grades 1-3 or Pass

Scottish School Leaving Certificate Lower Grade

Scottish Intermediate 2

SUPE Ordinary

Northern Ireland Junior Certificate

SECTION 3:

A-level, S-level, A2-level, AS-level

International Baccalaureate

Vocational A-level (AVCE)

Scottish Higher

Scottish SCE/SLC/SUPE at Higher Grade

Scottish Higher School Certificate

Certificate of Sixth Year Studies/ Advanced Higher Grades

Northern Ireland Senior Certificate

SECTION 4:

Overseas school leaving exam or certificate

SECTION 5:

University or CNAA first degree, e.g. BA, BSc

University or CNAA diploma or Foundation Degree

Postgraduate degree, e.g. MA, MSc, MPhil, DPhil, PhD

Teacher Training qualification

SECTION 6:

Foundation/Advanced (modern) apprenticeship completed

Other recognised trade apprenticeship completed

OCR/RSA

Other clerical or commercial qualification

Nursing qualification	City and Guilds Certificate
	BEC/TEC First Certificate/ First or General Diploma
	BTEC/ (General/ Ordinary) National Certificate (ONC) or Diploma(OND)
	Higher National Certificate (HNC) or Diploma (HND)
	NVQ/SVQ/GNVQ/GSVQ

SECTION 7:

Other recognised academic or vocational qualifications	

APPENDIX 7 - FINDINGS FOR CHAPTER 5

Exploring difference in household income in those of pensionable age and those of working age

	n	**Mean**	**SD**	**t**
Age				t(339)=-.02, p=.98
<60	333	27451	30489.06	
>60	8	27235	13065.21	

Testing relationships between continuous independent variables – Age

N=341	**Pearson Correlation**	**Sig. (2-tailed)**
Household income	.05	.41
Perceived severity of cervical cancer	-.85	.16
Perceived risk of getting cervical cancer	-.06	.25

Testing relationships between continuous and categorical independent variables – Age

	n	Mean	SD	F (ANOVA)
NS-SEC3				F(3,337)= 1.65, p=.18
Managerial and professional occupations	94	3.00	.75	
Intermediate occupations	83	2.78	.73	
Routine and manual occupations	143	2.77	1.0	
Not classifiable	21	3.05	1.6	
Total	341	2.85	.93	
Education				<.01
None	62	42.23	14.9	
GCSE or equivalent	139	36.50	7.11	
A Level or higher education (below degree)	94	37.52	7.33	
Degree or higher	44	39.11	6.68	

Testing relationships between continuous and binary categorical independent variables – Age

	n	Mean	SD	t
Whether respondent attends cervical screening				t(331)=.04, p=.97
Regular cervical screening	293	37.55	7.32	
Irregular cervical screening or non-attendees	40	37.50	9.13	
Ethnicity				t(339)=-.14, p=.89
White	306	38.15	9.06	
Other	35	38.37	10.7	
Aware of HPV				t(338)=-.27, p=.79
Yes	80	37.90	6.87	
No	260	38.22	9.85	

Testing relationships between continuous independent variables – Household income

N=341	Pearson Correlation	Sig. (2-tailed)
Perceived severity of cervical cancer	.06	.26
Perceived risk of getting cervical cancer	.05	.39

Testing relationships between continuous and categorical independent variables – Household income

	n	Mean	SD	F (ANOVA)
NS-SEC3				F(3,337)=.91, p=.44
Managerial and professional occupations	94	30605.12	46719.56	
Intermediate occupations	83	24503.84	17756.39	
Routine and manual occupations	143	26271.79	21490.59	
Not classifiable	21	32936.91	25398.1	
Total	341	27446.45	30186.52	
Education				F(3,335)=2.56, p=.06
None	62	29647.34	27585.01	
GCSE or equivalent	139	26150.97	26723.82	
A Level or higher education (below degree)	94	22808.47	17518.10	
Degree or higher	44	37388.25	54490.63	

Testing relationships between continuous and binary categorical independent variables – Household income

	n	Mean	SD	t
Whether respondent attends cervical screening				t(331)=1.20, p=.23
Regular cervical screening	293	28122.66	317898.99	
Irregular cervical screening or non-attendees	40	21966.98	16131.30	
Ethnicity				t(339)=-.1, p=.92
White	306	27390.17	30895.27	
Other	35	27938.48	23439.12	
Aware of HPV				t(338)=1.3, p=.19
Yes	80	31290.59	42208.58	
No	260	26254.20	25431.82	

Testing relationships between continuous independent variables – Perceived severity of cervical cancer

N=341	Pearson Correlation	Sig. (2-tailed)
Perceived risk of getting cervical cancer	-.01	.87

Testing relationships between continuous and categorical independent variables – Perceived severity of cervical cancer

	n	Mean	SD	F (ANOVA)
NS-SEC3				F(3,337)=.26, p=.85
Managerial and professional occupations	94	9.43	1.07	
Intermediate occupations	83	9.30	1.18	
Routine and manual occupations	143	9.43	1.38	
Not classifiable	21	9.33	1.06	
Total	341	9.40	1.23	
Education				F(3,335)=1.32, p=.27
None	62	9.66	.75	
GCSE or equivalent	139	9.32	1.31	
A Level or higher education (below degree)	94	9.31	1.50	
Degree or higher	44	9.45	.79	

Testing relationships between continuous and binary categorical independent variables – Perceived severity of cervical cancer

	n	Mean	SD	t
Whether respondent attends cervical screening				t(331)=.76, p=.45
Regular cervical screening	293	9.88	2.17	
Irregular cervical screening or non-attendees	40	9.60	2.41	
Ethnicity				t(339)=.12, p=.90
White	306	9.40	1.25	
Other	35	9.37	1.09	
Aware of HPV				t(338)=.1, p=.92
Yes	80	9.41	1.11	
No	260	9.40	1.26	

Testing relationships between continuous and categorical independent variables – Perceived risk of cervical cancer

	n	Mean	SD	F (ANOVA)
NS-SEC3				F(3,337)=1.2 p=.35
Managerial and professional occupations	94	3.60	1.04	
Intermediate occupations	83	3.42	.96	
Routine and manual occupations	143	3.68	1.15	
Not classifiable	21	3.67	.58	
Total	341	3.59	1.05	
Education				F(3,335)=.58, p=.63
None	62	3.65	1.23	
GCSE or equivalent	139	3.50	1.09	
A Level or higher education (below degree)	94	3.63	.96	
Degree or higher	44	3.70	.82	

Testing relationships between continuous independent variables – Perceived risk of cervical cancer

	n	Mean	SD	t
Whether respondent attends cervical screening				t(331)=.39, p=.70
Regular cervical screening	293	3.62	1.02	
Irregular cervical screening or non-attendees	40	3.55	1.13	
Ethnicity				t(339)=-.9, p=.37
White	306	3.58	1.07	
Other	35	3.74	.82	
Aware of HPV				t(338)=1.18, p=.24
Yes	80	3.71	.97	
No	260	3.55	1.07	

Testing relationships between categorical independent variables – NS-SEC3

	Managerial/ professional occupations *n* (%)	**Intermediate occupations *n* (%)**	**Routine/ manual occupations *n* (%)**	**Not classifiable *n* (%)**	**Total *n* (%)**	**χ^2**
Whether respondent has smear tests						χ^2 (3)= 3.33 p=.3
Has regular cervical screening	84 (90.3)	76 (91.6)	118 (84.3)	15 (88.2)	293 (88.0)	
Has irregular cervical screening or non-attendee	9 (9.7)	7 (8.4)	22 (15.7)	2 (11.8)	40 (12.0)	
Total	93 (100)	83 (100)	140 (100)	17 (100)	333 (100)	
Ethnicity						χ^2(3)=11.21, p<.01, V=.21
White	86 (91.5)	73 (88)	133 (93)	14 (66.7)	306 (89.7)	
Other	8 (8.5)	10 (12.0)	10 (7.0)	7 (33.3)	35 (10.3)	
Total	94 (100)	83 (100)	143 (100)	21 (100)	341 (100)	
Aware of HPV						χ^2 (3)= 15.99, p<.01, V=.22
Yes	34 (36.2)	22 (26.8)	22 (15.4)	2 (9.5)	80 (23. 5)	
No	60 (63.8)	60 (73.2)	121 (84.6)	19 (90. 5)	260 (76. 5)	
Total	94 (100)	82 (100)	143 (100)	21 (100)	340 (100)	

Testing relationships between categorical independent variables – Ethnicity

	White *n* (%)	**Other *n* (%)**	**Total *n* (%)**	**χ^2**
Aware of HPV				χ^2(1)=.88, p=.41
Yes	74 (24.3)	6 (17.1)	80 (23.5)	
No	231 (75.7)	29 (82.9)	260 (76.5)	
Total	305 (100)	35 (100)	340 (100)	

Testing relationships between categorical independent variables – Education

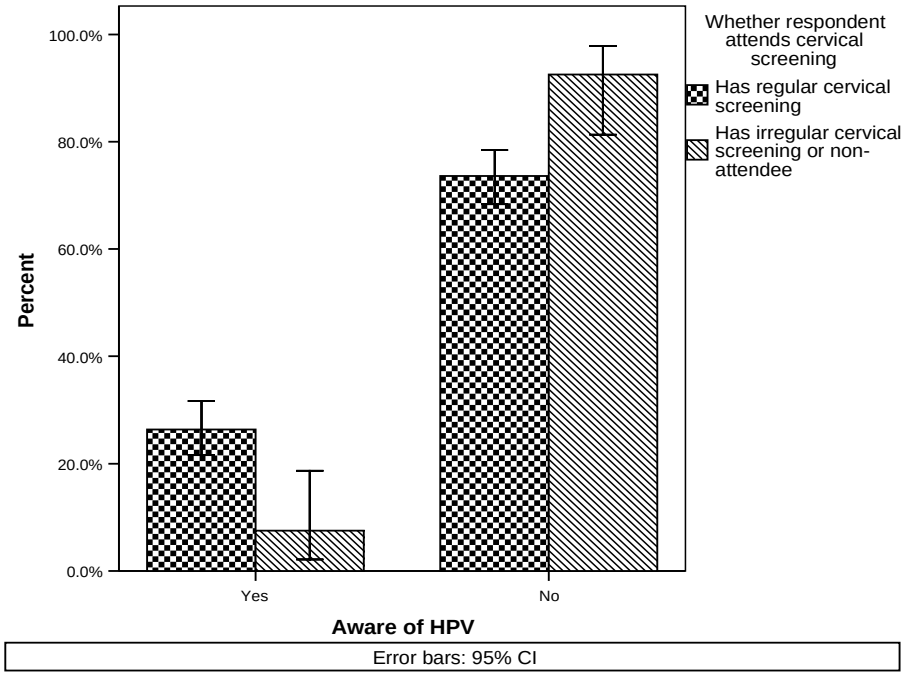
	None *n* (%)	**GCSE or equivalent *n* (%)**	**A Level/Higher education (below degree) *n* (%)**	**Degree or higher *n* (%)**	**Total *n* (%)**	**χ^2**
Ethnicity						$\chi^2(3)=6.1$, p=1
White	53 (85.5)	131 (94.2)	81 (86.2)	39 (88.6)	304 (89.7)	
Other	9 (14.5)	8 (5.8)	13 (13.8)	5 (11.4)	35 (10.3)	
Total	62 (100)	139 (100)	94 (100)	44 (100)	339 (100)	
Whether respondent attends cervical screening						<.01
Has regular cervical screening	41 (73.2)	126 (92)	85 (90.4)	39 (88.6)	291 (87.9)	
Has irregular cervical screening or non-attendee	15 (26.8)	11 (8)	9 (9.6)	5 (11.4)	40 (12.1)	
Total	56 (100)	137 (100)	94 (100)	44 (100)	331 (100)	
Aware of HPV						$\chi^2(3)=30.9$, p<.01, V=.3
Yes	5 (8.1)	21 (15.2)	35 (37.2)	18 (40.9)	79 (23.4)	
No	57 (91.9)	117 (84.8)	59 (62.8)	26 (59.1)	259 (76.6)	
Total	62 (100)	138 (100)	94 (100)	44 (100)	338 (100)	
NSSEC						$\chi^2(9)=121.3$, p<.01, V=.3
Managerial/ professional occupations	1 (1.6)	22 (15.8)	43 (45.7)	28 (63.6)	94 (27.7)	
Intermediate occupations	7 (11.3)	37 (26.6)	26 (27.7)	13 (29.5)	83 (24.5)	
Routine/ manual occupations	42 (67.7)	75(54)	23 (24.5)	3 (6.8)	143 (42.2)	
Not classifiable	12 (19.4)	5 (3.6)	2 (2.1)	0 (0)	19 (5.6)	
Total	62 (100)	139 (100)	94 (100)	44 (100)	339 (100)	

Testing relationships between categorical independent variables – Whether respondent attends for cervical screening

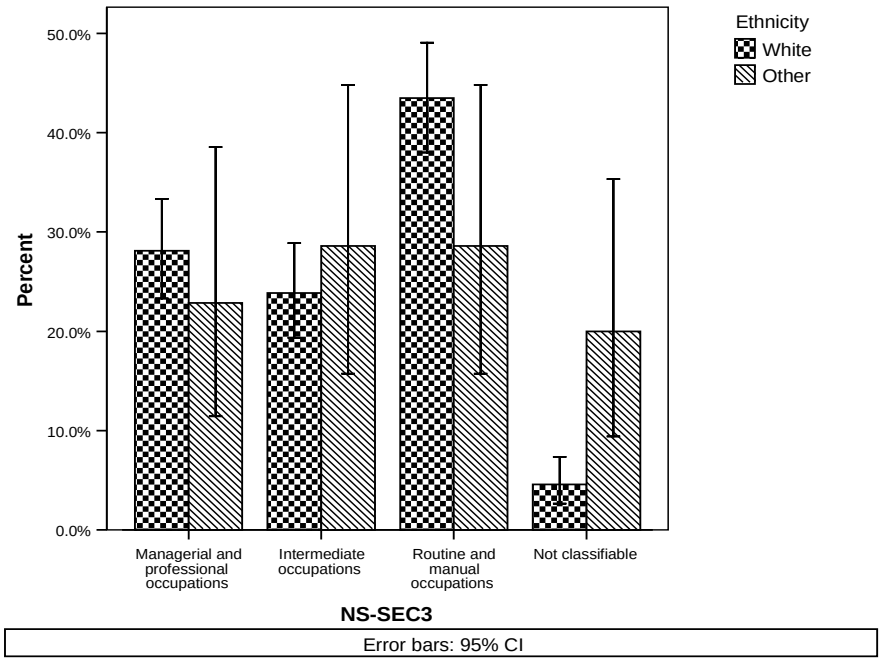
	Has regular cervical screening	Has irregular cervical screening or non-attendee	**Total *n* (%)**	χ^2
Ethnicity				$\chi^2(1)=2.93$, p=.09
White	267 (91.1)	33 (82.5)	304 (89.9)	
Other	26 (8.9)	7(17.5)	34 (10.1)	
Total	293 (100)	40 (100)	333 (100)	
Aware of HPV				$\chi^2(1)=6.85$, p<.01, V=.14
Yes	77 (26.1)	3 (7.1)	80 (24.1)	
No	215 (85.3)	37 (14.7)	252 (75.9)	
Total	292 (100)	40 (100)	332 (100)	

APPENDIX 8 - GRAPHS FOR CHAPTER 5

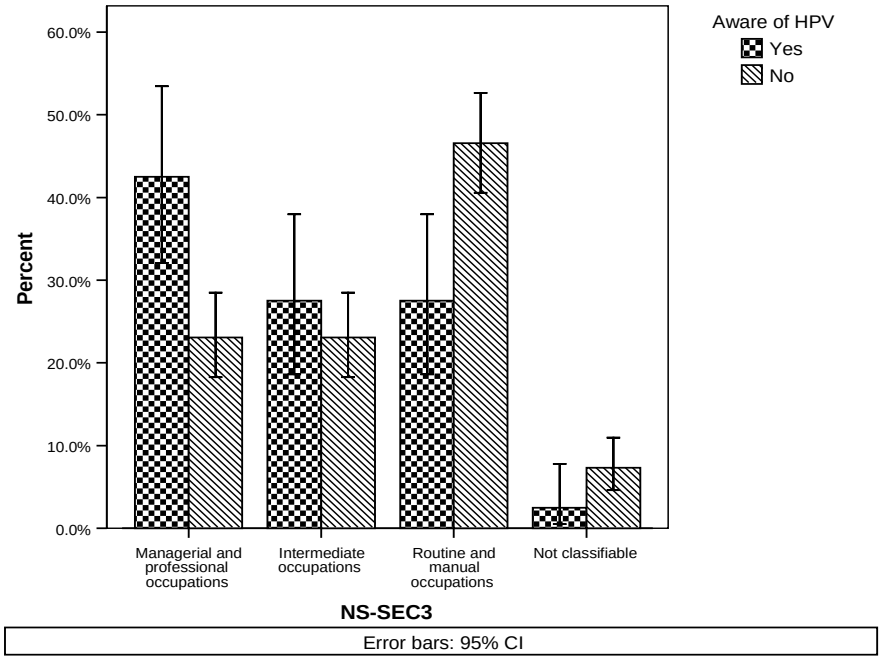
Bar graph for whether the respondent attends cervical screening grouped by whether they were aware of HPV



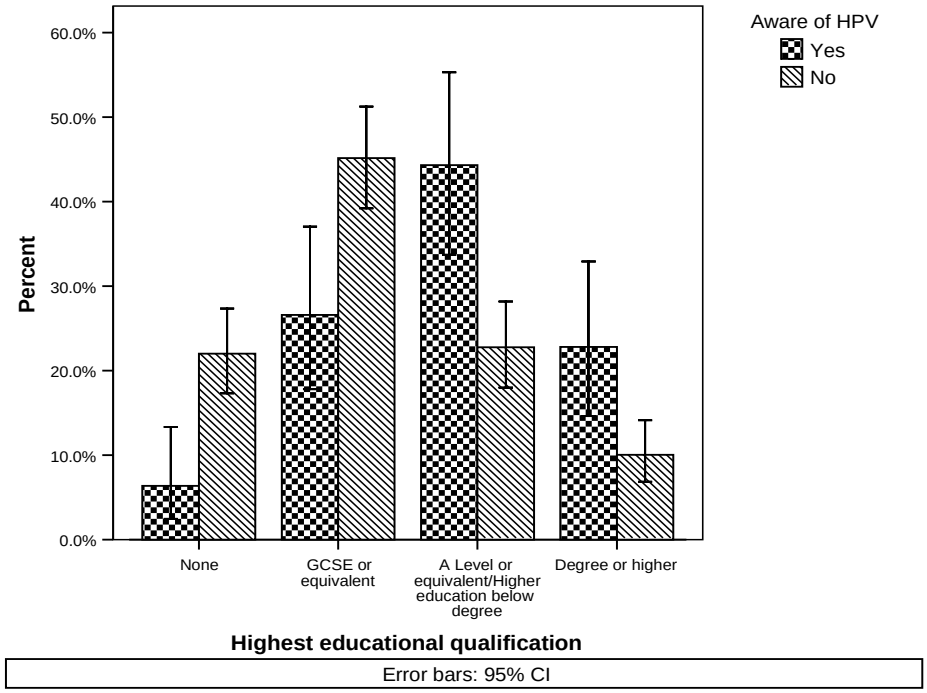
Bar graph for NS-SEC3 grouped by ethnicity



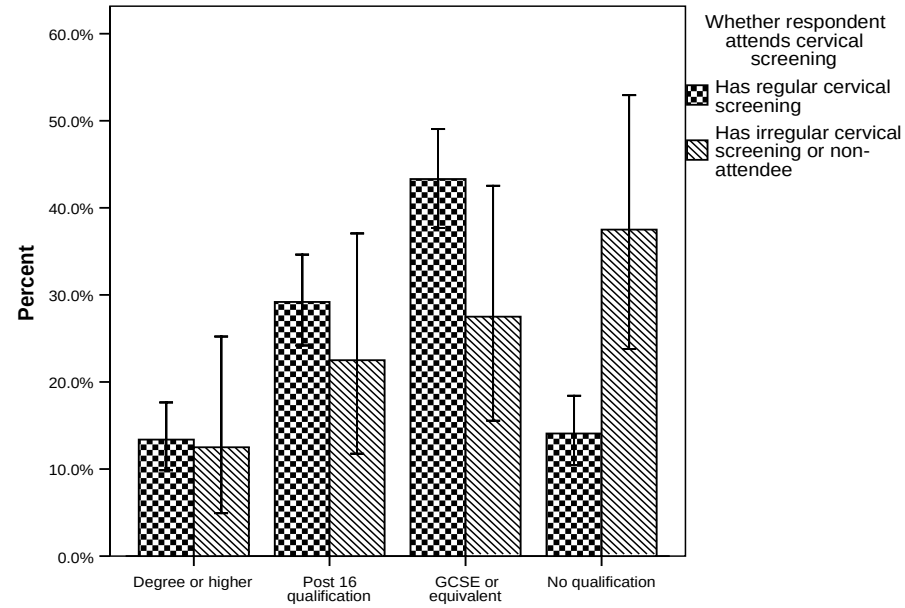
Bar graph for NS-SEC3 grouped by whether the respondent was aware of HPV



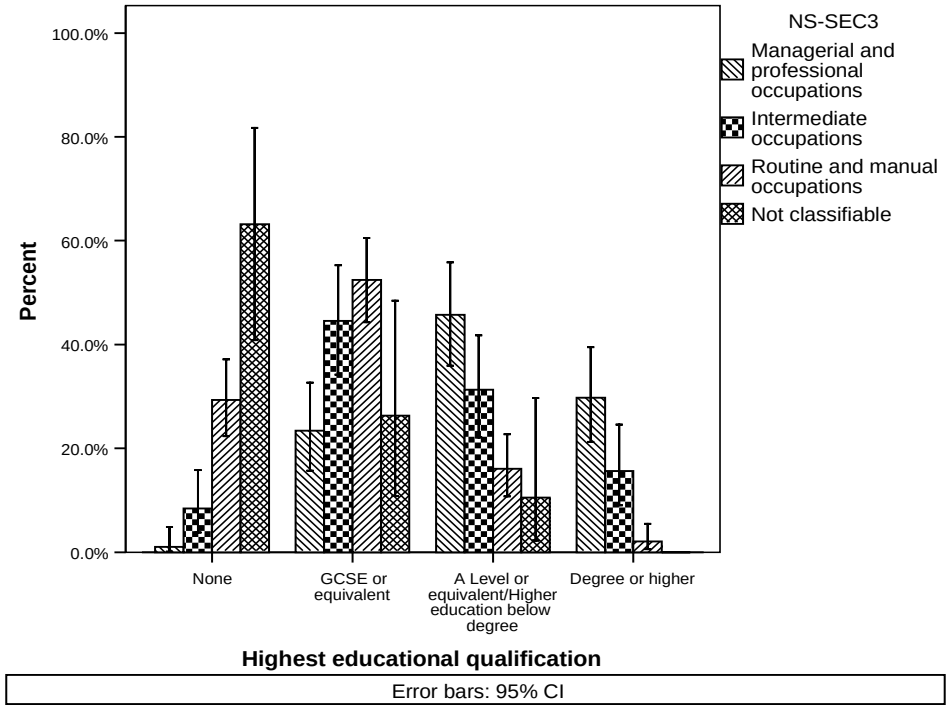
Bar graph for education grouped by whether the respondent was aware of HPV



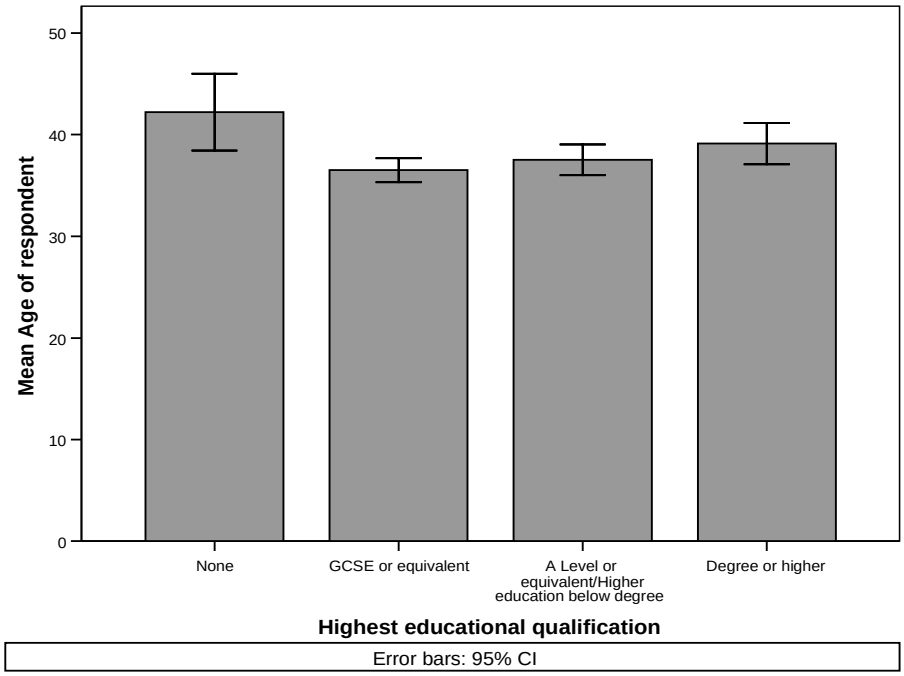
Bar graph for education grouped by whether the respondent attends cervical screening



Bar graph for education grouped by NS-SEC3



Bar graph for mean age of respondents in each education group



APPENDIX 9 - PUBLICATION FROM CHAPTER 5

ELSEVIER

Journal of Adolescent Health 44 (2009) 446–451

JOURNAL OF ADOLESCENT HEALTH

Original article

Mothers' and Adolescents' Beliefs about Risk Compensation following HPV Vaccination

Laura A.V. Marlow, M.Sc.*, Alice S. Forster, M.Sc., Jane Wardle, Ph.D., and Jo Waller, Ph.D.

Health Behaviour Research Centre, Department of Epidemiology and Public Health, UCL, Gower Street, London, WC1E 6BT UK

Manuscript received June 4, 2008; manuscript accepted September 24, 2008

Abstract

Purpose: To examine the prevalence and predictors of the belief that human papillomavirus (HPV) vaccination will result in "risk compensation," that is, will increase risky sexual behavior.

Methods: Two surveys were carried out: with 332 mothers (Study 1) and 360 adolescent girls (Study 2). The outcome measure was the score on a risk compensation scale tapping beliefs that HPV vaccination would increase risky sexual behavior.

Results: Among mothers, those from the lowest income group ($F = 4.38$, $p < .01$), from ethnic minority backgrounds ($F = 7.41$, $p < .01$), and who did not attend cervical screening ($F = 9.96$, $p < .01$), had the highest risk compensation scores. Among adolescents, girls with lower educational attainment ($F = 4.14$, $p < .05$), from ethnic minority backgrounds ($F = 6.60$, $p < .001$), and who felt themselves to be less sexually experienced than their peers ($F = 3.31$, $p < .05$), had the highest scores. Girls showed lower belief in risk compensation in relation to their own behavior (personal compensation) than for "girls in general" (general compensation; $t = 13.68$, $p < .001$). Lower knowledge of HPV was associated with higher personal risk compensation beliefs ($F = 4.26$, $p < .05$).

Conclusions: A significant minority of mothers and adolescents themselves say that HPV vaccination would increase the chance of risky sexual behavior. Because risk compensation beliefs are likely to predict HPV vaccine acceptance, identifying the basis for these beliefs and providing appropriate information and education to parents and adolescents will be vital. Following the introduction of vaccination, it will be important to discover whether risk compensation actually takes place, and every effort should be made to ensure it does not.

Keywords: STI; Sexual behavior; Perceived risk; Vaccination; HPV

It is well established that high-risk types of human papillomavirus (HPV) are the main causal agent in cervical carcinogenesis [1]. Highly effective prophylactic vaccines have been developed targeting the HPV subtypes (16 and 18) responsible for 70% of cervical cancers [2,3]. In the United Kingdom, HPV vaccination will be offered to girls age 12 to 13 years old from September 2008 with a "catch-up" program for girls up to 18 years. The vaccine has been recommended in the United States since June 2006, but has met with some opposition from conservative religious groups who argue that it will encourage promiscuity. Although these views are less prominent in the UK, groups such as "Christian Voice" nonetheless suggest that HPV vaccination condones what they describe as "immoral" behavior, and these views have been widely reported in the press: "Religious groups claim the vaccinations will encourage promiscuity, teenage pregnancy and infertility. Stephen Green… of Christian Voice said, "Since the vaccine works best before the onset of sexual activity… Anyone giving this drug to a girl is telling her 'I think you are a slag'" (Daily Telegraph, 12/07). Concern has also been expressed about possible adverse effects on safer sex behaviors, which would put adolescents at risk of other sexually transmitted infections (STIs).

The NatCen data collection was funded by GSK Biologicals. Jo Waller, Jane Wardle, and Laura Marlow are supported by Cancer Research UK. Alice Forster is supported by a UCL Dean's studentship.

*Address correspondence to: Laura Marlow, M.Sc., Health Behaviour Research Centre, University College London, Gower Street, London WC1E 6BT UK.

E-mail address: l.marlow@ucl.ac.uk

1054-139X/09/$ – see front matter
doi:10.1016/j.jadohealth.2008.09.011

The notion that vaccination might make girls engage in more risky sexual behavior can be conceptualized within the theoretical framework of risk compensation [4]. Risk compensation theory proposes that individuals adjust their behavior so that their perceived level of personal risk is in line with a target level of risk they believe to be acceptable. The target level of risk is based on perceived costs and benefits of enacting (or not enacting) a behavior, whereas perceived risk is based on factors such as risk information or personal experience. Individuals attempt to compromise on risk, not reduce it to zero, so if one risk factor is reduced, the individual might feel able to tolerate a higher risk exposure in another behavior. Risk compensation theory would suggest that after HPV vaccination, adolescents might increase risky sexual behavior because of the protection against an STI the vaccine affords.

Two studies have examined risk compensation in relation to other vaccines. Brewer et al [5] used the context of Lyme disease vaccination, and found decreases for two out of five behaviors (e.g., using tick repellent) in the vaccinated group. However, rates of protective behaviors were still higher than in the unvaccinated control group where they were lower at both time points. In a sample of Ugandan men, 50% reported that they would not use condoms if they were given an HIV vaccine [6], lending support to the possibility of risk compensation following vaccination against an STI. However, direct comparisons of HIV with HPV may not be appropriate. Although the cause and consequences of HIV are well known, HPV knowledge is poor. In the HPV context, risk compensation in terms of sexual behavior could be anticipated if immunized girls believed that HPV vaccine protected against STIs generally rather than only cervical cancer.

There have been no studies examining actual risk compensation in the context of the HPV vaccination, but beliefs about the impact of the vaccine on sexual behavior have been assessed. Marlow et al [7] found that around 12% of British parents thought the vaccine would encourage sex, and 18% thought it would encourage unsafe sex, although in an Australian study fewer parents (5%) were concerned that the vaccine would lead to promiscuity [8]. Risk compensation beliefs have been associated with lower intention to vaccinate daughters against HPV in studies in the United States, the United Kingdom, Finland, China, and Canada [7,9–13], as well as in studies of other STI vaccinations [14].

Adolescents appear to share a belief in risk compensation in relation to other STI vaccines. In one U.S.-based study, 77% of adolescents believed that an HIV vaccine would make adolescents in general more likely to take part in risky sexual behavior [15], and more recently, 37% of adolescents in Finland agreed that vaccinations against STIs would result in earlier sexual debut [11]. However, neither of these studies asked adolescents about HPV vaccination nor about anticipated change in their own behavior following vaccination.

The results presented in this paper come from two studies. The first examined predictors of belief in risk compensation in a sample of mothers. The second evaluated beliefs about risk compensation in a sample of older adolescent girls.

Study 1: Mothers' Perceptions of Risk Compensation

Methods

Participants

Mothers were recruited as part of the National Centre for Social Research (NatCen) omnibus survey [16]. The NatCen survey is a monthly population representative survey of men and women in England, Scotland, and Wales. Potential addresses are randomly selected using the Postcode Address File (PAF), 25 addresses are selected from each postcode sector (n = 122), giving 3050 addresses. One adult over 16 years old is randomly selected to take part in a home-based computer assisted interview. A module assessing HPV knowledge and attitudes was included in two waves of the survey between November 2006 and February 2007. Questions in this module were only asked in interviews with women. Women with a daughter aged 16 years or younger are included in these analyses. NatCen follow the Social Research Association Ethical guidelines.

Measures

After being given brief information about HPV (including its sexually transmitted nature and the development of a vaccine), mothers responded on a five-point scale ("strongly disagree" to "strongly agree") to a set of attitude statements. Two considered anticipated risk compensation: "Having the HPV vaccination might make girls more likely to have sex" and "Girls who had the HPV vaccination would be more likely to have unprotected sex."

Mothers reported their age, education level, ethnicity, their partner's, and their own income (which were combined and divided into quartiles), and their employment status (classified using the National Statistics Socioeconomic Classification, NS-SEC [17], as a measure of occupational social class). They were asked whether they had been aware of HPV before taking part in the interview (responses: yes or no). They were also asked about their cervical screening history, selecting one of four statements that most described their situation. Those who selected "I regularly have cervical cancer screening and do not need reminding" or "I regularly have cervical cancer screening but do need reminding" were coded as "regular attenders." Those who selected "I do not have regular cervical cancer screening in spite of reminders to do so" or "I have never had cervical cancer screening" were coded as "nonregular attenders."

Analysis

An anticipated risk compensation score was created by combining responses to the two "beliefs about risky sexual behavior" variables (Cronbach's α =.71). The score range was 0–8, with higher scores indicating greater anticipated compensation. Demographic differences in mean scores were analyzed using univariate ANOVAs, and Tukey's

HSD post hoc tests established where any significant differences lay.

Results

In total, 1,620 women participated in the NatCen survey (response rate = 54%); of these, 332 had at least one daughter under 16 years and were included in further analyses. The mothers mean age was 37.41 (range: 18–64). They were mostly white (91%) and most had passed at least school examinations at age 16 (GCSEs or equivalent; 83%). Median combined annual income was £20,280 (range: £1,300–£370,000) and of those women who were employed, 44% were in routine/manual occupations. Attendance at cervical screening was high, with 88% of mothers reporting they attended regularly. Only 24% of participants were previously aware of HPV.

Almost a quarter of mothers agreed or strongly agreed that girls would be more likely to have sex (22.6%) or unprotected sex (26.5%) following HPV vaccination, although the majority disagreed with both statements (57.7% and 53.8%, respectively). The mean anticipated risk compensation score was 3.03 (SD = 1.75) out of a possible 8, indicating an overall tendency to disagree.

ANOVAs established whether risk compensation was associated with demographic or behavioral variables (Table 1). Mothers who did not attend regularly for cervical screening were more likely to anticipate risk compensation following HPV vaccination, F (1, 323) = 9.96, p = .002. There were differences between the ethnic groups, F (2, 320) = 7.41, p = .001, with black mothers (p = .016) and Asian mothers (p = .016) being more likely to anticipate risk compensation than white mothers. There were also differences by income group, F (3, 274) = 4.38, p = .005, with mothers in the lowest quartile more likely to anticipate risk compensation than those in the higher quartiles (quartile 2; p = .025 or quartile 3; p = .006).

Table 1
ANOVAs for anticipated risk compensation among mothers of girls up to 16 years old

	%[a]	N	Anticipated risk compensation	
			Mean	F (p-value)
Age				
16–24	4.2	14	3.79	1.32 (.263)
25–34	30.4	101	3.07	
35–44	50.0	166	2.94	
45–54	13.9	46	3.41	
55–64	1.5	5	3.80	
Education				
None	16.4	53	3.32	1.23 (.299)
GCSE or equivalent (O Level)	42.3	137	3.22	
A Level/Higher (below degree)	28.1	91	2.86	
First degree	13.3	43	2.84	
Combined income				
Quartile 1 (< £8840)	22.3	74	3.66	4.38 (.005)
Quartile 2 (£8840–£20,020)	19.9	66	2.78	
Quartile 3 (£20,020–£36,790)	21.4	71	2.66	
Quartile 4 (>£36,790)	21.1	70	2.94	
NS-SEC				
Managerial and professional occupations	29.6	93	2.91	0.46 (.632)
Intermediate occupations	26.4	83	3.14	
Routine and manual occupations	43.9	138	3.13	
Ethnicity				
White British or other	91.4	298	2.97	7.41 (.001)
Black or black mixed	4.3	14	4.38	
Asian or Asian mixed	4.3	14	4.38	
Heard of HPV				
No	75.9	252	3.19	2.39 (.123)
Yes	23.8	79	2.82	
Smear attendance				
No	11.7	39	3.95	9.96 (.002)
Yes	87.7	291	2.98	

[a] Unaccounted % is missing data.

Study 2: Adolescents' Perceptions of Risk Compensation

Methods

Participants

The adolescent sample were female students recruited through two further education colleges in South East England (similar to grades 11 and 12 in U.S. high schools). The geographical areas were selected for convenience, and the colleges were selected to contrast in sociodemographic background and proportion of ethnic minority students. One college had a high proportion (61%) of students from ethnic minority backgrounds and 48% receiving an Educational Maintenance Award (EMA; a weekly payment to students with a low annual household income). The other had a smaller proportion of ethnic minority students (15%) and 9% receiving EMA.

Students were asked to complete the questionnaire during a tutorial session between April and July 2007. For logistical reasons, a small proportion of students completed the questionnaire in two parts, a week apart. Students who chose not to participate returned the questionnaire blank. The study was approved by UCL Research Ethics Committee.

Measures

Anticipated risk compensation for girls in general was measured by asking girls to respond to two statements; "The HPV vaccination will make girls more likely to have sex" and "Girls who had the HPV vaccination would be more likely to have unprotected sex." Girls also responded to two similar items relating to their own behavior; "If I had the HPV vaccination I would be more likely to have sex" and "If I had the HPV vaccination I would be more likely to have unprotected sex." Because in the earlier study of mothers, around one-quarter of the sample had responded "neither agree nor disagree" to the risk compensation items and we wanted to encourage a more definitive answer, we used a four-point scale (strongly disagree, disagree, agree, strongly agree) with no middle option, to ensure a wider range of responses.

Table 2
ANOVAs for anticipated risk compensation among adolescent girls

			Anticipated risk compensation of others ("general compensation")		Anticipated risk compensation for self ("personal compensation")	
	%*	N	Mean	F (p-value)	Mean	F (p-value)
Age						
16 years	14.6	50	2.60	2.03 (.133)	1.58	0.31 (.733)
17 years	63.0	216	2.51		1.42	
18/19 years	22.4	77	2.90		1.47	
GCSEs (grade A to C)						
0–4	12.0	40	2.78	4.14 (.017)	1.50	0.06 (.938)
5–9	45.9	153	2.76		1.45	
10–16	42.0	140	2.31		1.42	
Ethnicity						
White British or other	59.0	206	2.32	6.60 (<.001)	1.47	0.94 (.422)
Black or black mixed	24.1	84	3.28		1.54	
Asian or Asian mixed	12.6	44	2.84		1.48	
Other	4.3	15	2.33		0.93	
Heard of HPV						
Yes	5.8	21	2.63	2.28 (.132)	1.48	0.72 (.398)
No	94.2	339	2.14		1.24	
HPV knowledge score						
Low (0–4)	7.8	27	2.52	0.15 (.859)	2.07	4.26 (.015)
Medium (5–9)	33.3	116	2.65		1.52	
High (10–15)	58.9	205	2.57		1.34	
Sexual experience						
Less experienced	37.7	105	2.81	3.31 (.038)	1.29	1.94 (.145)
The same level of experience	29.3	135	2.52		1.61	
More experienced	13.1	47	2.19		1.38	

* Unaccounted % is missing data.

Sociodemographic variables included age, education (number of GCSEs grade A to C; these are school examinations passed at age 16 and are related to measures of parental socioeconomic status [SES] [18]) and ethnicity. Sexual experience was assessed by asking students: "Compared to other people the same age and sex as you, how sexually experienced do you think you are." Responses were made on a five-point scale from "a lot less experienced" to "a lot more experienced," with an option for "do not wish to answer." Awareness of HPV was assessed by asking girls at the beginning of the questionnaire "have you ever heard of HPV" (yes or no).

Students read a page of information about HPV and vaccination. The information was developed following interviews and focus groups. It explained HPV, its link with cervical cancer, and the development of a vaccine. It also included information about the prevalence and transmission of HPV. After reading the information students completed a knowledge measure consisting of 15 true/false statements (e.g., "HPV often has no visible signs or symptoms"). There was also a response option for "don't know" (coded as incorrect). Respondents scored 1 for each correct item and a total score was calculated. They were then divided into one of three groups based on their score (0–4, 5–9, 10–15).

Analysis

The items relating to anticipated risk compensation of others were combined to create a score reflecting "general compensation" beliefs (Cronbach's $\alpha = .80$) and the items relating to "self" were combined to create one variable relating to "personal compensation" beliefs (Cronbach's $\alpha = .69$). Each scale ranged from 0 to 6. Univariate ANOVAs were used to identify significant predictors of anticipated risk compensation and Tukey's HSD post hoc tests established where the significant differences lay (Table 2).

Results

The main questionnaire was completed by 328 girls (7 refused to take part). Part one of the two-part questionnaire was completed by 105 girls, of whom 58 completed part two. The full questionnaire was therefore completed by 386 girls. None of the outcome variables differed between the two completion types, so they were combined for further analyses. Items used to create the anticipated risk compensation scores were missing for 26 respondents; these cases were excluded, leaving 360 cases. The mean age of participants was 17.11 years (range: 16–19) and the median number of GCSEs grade A–C was 9 (range: 0–16). The sample was ethnically diverse (white = 59%, black = 24%, Asian = 13%). Very few girls had heard of HPV before taking part in the study (6%). Most felt they were equally (29%) or less (38%) sexual experienced than others their age, with 13% rating themselves as more experienced and 20% not willing to answer this question.

Overall, 23.2% agreed and 8.4% strongly agreed that HPV vaccination would make girls in general more likely to have

sex, and 29.7% agreed and 7.8% strongly agreed that it would make girls more likely to have unprotected sex. A smaller proportion agreed with the items relating to their own sexual behavior: 16.9% thought it would make them more likely to have sex (13.5% agreed and 3.4% strongly agreed), and 8.4% thought it would make them more likely to have unprotected sex (7.0% agreed and 1.4% strongly agreed). Mean scores indicated a tendency to disagree with the statements: the mean "general compensation" score was 2.60 (SD = 1.43), whereas the mean "personal compensation" score was significantly lower at 1.47, SD = 1.28, ($t = 13.68$, $p < .001$).

"General compensation" was not associated with age, previous awareness of HPV, or HPV knowledge score. However, there were significant associations with education, $F(2, 330) = 4.14$, $p = .017$, ethnicity, $F(3, 345) = 6.60$, $p < .001$, and sexual experience, $F(2, 284) = 3.31$, $p = .038$. Post hoc analyses revealed that girls with lower educational attainment scored higher on the "general compensation" scale ($p = .019$), girls from black backgrounds scored higher than girls from white backgrounds ($p < .001$), and girls who reported having "less sexual experience than others their age" scored higher than those who reported "more sexual experience" ($p = .037$).

For "personal risk compensation" there were no significant demographic associations. The only significant predictor of a higher "personal compensation" score was HPV knowledge score, $F(2, 344) = 4.26$, $p = .015$, with a higher mean "personal compensation" score among those who answered fewer than five items correctly (mean = 2.07), compared to those who answered more than 10 items correctly (mean = 1.34, $p = .013$).

Discussion

Vaccination against HPV is expected to be highly acceptable among parents, but one factor that may predict nonacceptance is the belief that the vaccination will lead to an increase in risky sexual behavior [7,9–11]. In this paper we explored the prevalence and sociodemographic predictors of this belief among mothers and adolescent girls.

The average tendency was to disagree with the risk compensation statements; however, around one-quarter of mothers thought risk compensation might occur, and 16% of girls agreed that they may change their behavior following vaccination. At present, we do not know whether actual risk compensation behavior will occur following HPV vaccination, either in terms of increased risky sexual behavior or decreased cancer prevention efforts (e.g., cervical screening attendance), and this needs to be considered in less hypothetical studies as the vaccine is introduced.

Some girls believe that compensating for reduced risk following HPV vaccination is a possibility, and it is crucial that steps are taken to avoid this. The only significant predictor of "personal compensation" was a low HPV knowledge score, suggesting that educational programs may be an effective way to minimize risk compensation behavior. However, as all girls were given the same information yet knowledge scores varied widely, written information alone may not be sufficient for all girls; additional nonwritten information sources, such as opportunities for discussions with youth workers, may be beneficial.

One important observation was that anticipated risk compensation was higher when adolescent girls were asked about the behavior of "other girls" than when asked about themselves. This may be because girls speculate that others are more likely to demonstrate risky behaviors or responses to the statement about others may be less personalized, making it easier to respond truthfully. The majority of previous work looking at anticipated risk compensation following vaccination has asked adolescents about the behavior of others. Our findings suggest that it is important to distinguish between attitudes to others' and one's own behavior, but more work is needed to see which the most reliable predictor of behavior is.

Ethnicity, SES, and participation in relevant health behaviors emerged as predictors of general anticipated risk compensation for mothers and adolescent girls and the consistency across the two studies lends support to the validity of the findings. In both studies nonwhite ethnic groups were most likely to anticipate risk compensation for "girls in general," although ethnicity was not predictive of adolescents' beliefs about their own behavior. Belief in risk compensation was also associated with lower SES (operationalized as income for mothers, and academic achievement for adolescents).

We cannot tell from our findings whether these beliefs will translate into behavior. For mothers, these beliefs may lead to reluctance to consent to HPV vaccination and addressing risk compensation beliefs, as a barrier to vaccination may be particularly important within ethnic minority and lower SES groups. Most studies of HPV vaccine acceptability have not found significant variation between ethnic or SES groups [7,10], but this may be because sample sizes for nonwhite ethnic groups tend to be small.

We also found that women who participate regularly in cervical screening were less likely to hold risk compensation beliefs. This could be because declining the offer of cancer screening is associated with pessimistic beliefs about others' willingness to engage in health protective behaviors, but this finding needs to be explored further. Girls who rated themselves as less sexually experienced than their peers were more likely to hold risk compensation beliefs, but this may reflect an unrealistic view of peer sexual behavior. Reassuringly, sexual experience did not relate to beliefs about personal risk compensation behavior.

Limitations

There are several limitations to this study. Because the two studies used slightly different scales (with a "neither agree nor disagree" option offered to mothers but not adolescents), we cannot directly compare the proportion of mothers and

adolescents who agreed with the risk compensation statements. The percentage of adolescents agreeing with the statements may be overestimated (because the scale was forced choice) so these should be interpreted with caution. Also, we did not define explicitly what we meant by "sex," so this was left open to interpretation. The samples from the two studies were not related mother–daughter pairs, so despite the consistency in findings, we could not explore direct similarities in beliefs. The adolescent study used data collected from older adolescents who were around the age that will be offered the vaccine as part of the United Kingdom "catch-up" campaign. Studying this age group is particularly relevant in terms of risk compensation because they are more likely to be sexually active at present or in the near future. However, it means that the findings cannot be generalized to younger girls (age 12–13 years) who will be offered the United Kingdom's core vaccination program.

Although this is the first paper considering risk compensation beliefs in relation to HPV vaccination, a complete understanding of risk compensation following vaccination would encompass many more variables than we were able to measure. In accordance with risk compensation theory, it will be important to assess discrepancies between perceived risk and target level of risk that an individual accepts. According to Hedlund [19], the visibility of the vaccine and the effect this has on the individual should be measured, as should their perceived behavioral control, their motivation to change, and their reasons for performing their current safe behavior. At present, it is difficult to explore all of these aspects because the vaccination programme has not begun. In addition, adolescent sexual behavior can be highly irrational and so the applicability of risk compensation theory is debatable. Future research should explore these within the context of HPV vaccination.

Conclusions

One-third of girls think that changes in sexual behavior as a result of HPV vaccination are possible in relation to "other girls," but fewer believe they will change their own behavior. Mothers also share a concern about consequences for sexual behavior for girls generally. The risk compensation questions asked here were hypothetical, and it is not clear whether they will reflect real changes in sexual behavior, but they point to the need for more research. Following the introduction of the vaccination it will be important to discover whether risk compensation happens and to make every effort to avoid it occurring. Ensuring that older adolescent girls are provided with good information about the protection provided by the vaccination and the ongoing risks of other STIs will be an important part of this. Risk compensation beliefs are a barrier to vaccine acceptance among parents, and addressing these beliefs will be important, particularly in lower SES and ethnic minority groups, as well as nonregular cervical screening attendees—a public health challenge, given that these are notoriously hard to reach groups.

References

[1] Munoz N, Bosch FX, Castellsague X, et al. Against which human papillomavirus types shall we vaccinate and screen? The international perspective. Int J Cancer 2004;111:278–85.

[2] The Future II Study Group. Quadrivalent vaccine against human papillomavirus to prevent high-grade cervical lesions. N Engl J Med 2007; 356:1915–27.

[3] Paavonen J, Jenkins D, Bosch FX, et al. Efficacy of a prophylactic adjuvanted bivalent L1 virus-like-particle vaccine against infection with human papillomavirus types 16 and 18 in young women: an interim analysis of a phase III double-blind, randomised controlled trial. Lancet 2007;369:2161–70.

[4] Wilde GJS. The theory of risk homeostasis: implications for safety and health. Risk Anal 1982;2(4):209–25.

[5] Brewer NT, Cuite CL, Herrington JE, et al. RAPID COMMUNICATIONS: risk compensation and vaccination: can getting vaccinated cause people to engage in risky behaviors? Ann Behav Med 2007; 34:95–9.

[6] Hom DL, Johnson JL, Mugyenyi P, et al. HIV-1 risk and vaccine acceptability in the Ugandan military. J Acquir Immune Defic Syndr Hum Retrovirol 1997;15:375–80.

[7] Marlow LAV, Waller J, Wardle J. Parental attitudes to pre-pubertal HPV vaccination. Vaccine 2007;25:1945–52.

[8] Marshall H, Ryan P, Roberton D, Bagharst P. A cross-sectional survey to assess community attitudes to introduction of human papillomavirus vaccine. Aust N Z J Public Health 2007;31:235–42.

[9] Davis K, Dickman ED, Ferris D, et al. Human papillomavirus vaccine acceptability among parents of 10- to 15-year-old adolescents. J Low Genit Tract Dis 2004;8:188–94.

[10] Brabin L, Roberts SA, Farzaneh F, et al. Future acceptance of adolescent human papillomavirus vaccination: a survey of parental attitudes. Vaccine 2006;24:3087–94.

[11] Woodhall SC, Lehtinen M, Verho T, et al. Anticipated acceptance of HPV vaccination at the baseline of implementation: a survey of parental and adolescent knowledge and attitudes in Finland. J Adolesc Health 2007;40:466–9.

[12] Chan SS, Cheung TH, Lo WK, et al. Women's attitudes on human papillomavirus vaccination to their daughters. J Adolesc Health 2007; 41:204–7.

[13] Ogilvie GS, Remple VP, Marra F, et al. Parental intention to have daughters receive the human papillomavirus vaccine. CMAJ 2007; 177:1506–12.

[14] Zimet GD, Perkins SM, Sturm LA, et al. Predictors of STI vaccine acceptability among parents and their adolescent children. J Adolesc Health 2005;37:179–86.

[15] Webb PM, Zimet GD, Mays R, et al. HIV immunization: acceptability and anticipated effects on sexual behavior among adolescents. J Adolesc Health 1999;25:320–2.

[16] NatCen Omnibus. Available at: http://www.natcen.ac.uk/natcen/pages/or_commissionasurvey.htm. Accessed May 27, 2008.

[17] Office for National Statistics. The National Statistics Socio-economic Classification: User Manual. New York: Palgrave Macmillan, 2005.

[18] Haezewindt P. Focus on Social Inequalities: Education, Training and Skills. 2004. Available at: http://www.statistics.gov.uk/downloads/theme_compendia/fosi2004/Education.pdf. Accessed November 3, 2008.

[19] Hedlund J. Risky business: safety regulations, risk compensation, and individual behavior. Inj Prev 2000;6:82–90.

APPENDIX 10 - PUBLICATION FROM CHAPTER 6

DOI: 10.1111/j.1471-0528.2009.02412.x
www.bjog.org

Short communication

Adolescents' beliefs about their parents' human papillomavirus vaccination decisions

AS Forster, LAV Marlow, J Waller

Cancer Research UK Health Behaviour Research Centre, University College London, UK
Correspondence: Dr J Waller, Cancer Research UK Health Behaviour Research Centre, Department of Epidemiology and Public Health, University College London, Gower Street, London, WC1E 6BT, UK. Email j.waller@ucl.ac.uk

Accepted 14 September 2009. Published Online 20 October 2009.

A significant minority of parents are concerned that human papillomavirus vaccination will affect sexual behaviour. We explored this issue with 162 adolescent girls. Most (between 90 and 92%) did not perceive a connection between parental consent to vaccination and parental authorisation for sexual activity, but a small percentage believed that vaccination consent implied that they were old enough to have sex (8%), or that it was okay for them to be sexually active (10%). The findings are broadly reassuring, but highlight the need for vaccination information materials to clarify why the vaccine is administered before sexual debut.

Keywords Girls, HPV, immunisation, sexual behaviour, young women.

Please cite this paper as: Forster A, Marlow L, Waller J. Adolescents' beliefs about their parents' human papillomavirus vaccination decisions. BJOG 2010; 117:229–233.

Introduction

Oncogenic strains of human papillomavirus (HPV) cause 99% of cervical cancers[1] and are usually sexually transmitted. Prophylactic vaccines have been developed to protect against the two most common oncogenic HPV types (16 and 18) which cause around 70% of cervical cancers.[2] The vaccines are believed to be close to 100% effective at preventing infection with these HPV types if given to individuals who are naive to infection (this is normally equivalent to not having had sexual contact).[2] In the UK, 12–13-year-old girls are now offered a course of the three-dose HPV vaccine as part of the childhood immunisation programme, and adolescents up to the age of 18 years will be offered vaccination as part of a one-off 'catch-up' programme.

There is evidence that a significant proportion of parents are concerned about the safety and efficacy of the vaccine, and these concerns seem to be associated with weaker intentions to vaccinate.[3] An additional concern among parents is that the vaccine may encourage risky sexual behaviour. It has been suggested that adolescents will believe that, by allowing them to have the vaccine, their parents are implicitly giving them '*carte blanche*' approval for sexual activity, and this might encourage an earlier sexual debut.[4] A mother in a qualitative study conducted by Bair *et al.*[4] summarised this succinctly: 'We are giving them permission to have sex'. Although implicit approval does not necessarily mean that adolescents will engage in risky sexual behaviour, mothers have reported reservations about the HPV vaccine for this reason.[3]

There is a growing body of literature on parental attitudes to the HPV vaccine, although, as the immunisation programme has only recently been introduced, most studies have assessed beliefs hypothetically. There are fewer studies assessing adolescent attitudes and none that have asked girls about the meaning they take from their parents' agreement to or denial of the vaccine. Research has not examined the validity of parents' concerns about vaccination or, more subtly, parental approval for vaccination providing '*carte blanche*' approval for sexual activity. The present study explored whether adolescents intend to have the HPV vaccination, their beliefs about whether their parents would consent to vaccination, and their interpretation of the meaning of their parents' decision.

Methods

Female adolescents in UK school year 10 (age 14–15 years) were recruited from a high-achieving, state-funded, single-sex secondary school in London. This age group was chosen as these children will be involved in the HPV vaccination 'catch-up' programme, and the school was chosen

opportunistically. During a school lesson, the adolescents read a leaflet that provided information about HPV, cervical cancer, the HPV vaccine and cervical screening. The leaflet was developed following a series of interviews and focus groups. Participants were given as much time as they needed to read the leaflet and then completed a questionnaire anonymously. There was no incentive to complete the questionnaire.

The questionnaire assessed demographic characteristics (age, ethnicity, religion and whether they were practising that religion), vaccination intentions and perceptions of parents' beliefs about sexual behaviour and vaccination. Parental beliefs about HPV vaccination have been elicited in previous research.[3,5] The items were generated using this previous work and were piloted with a small opportunistic sample to minimise ambiguity.

Vaccination intentions were assessed by asking participants to indicate their own intention to receive the HPV vaccine using a four-point scale (ranging from 'very unlikely' to 'very likely'). Participants were also asked: 'do you think that your parents would let you have the HPV vaccine' ('no', 'not sure', 'yes').

We examined adolescents' perceptions of their parents' beliefs by asking them to respond to five statements assessing what they thought it would mean if their parents allowed them to have the HPV vaccine (responding on a five-point scale from 'strongly disagree' to 'strongly agree'). Beliefs about sexual behaviour were examined in two statements (e.g. 'If my parents let me have the HPV vaccine, it would mean that they think that I am old enough to have sex'), and three statements examined beliefs about vaccination/cancer (e.g. 'If my parents let me have the HPV vaccine, I would know that they agreed with vaccinations in general'). The study was approved by the University College London research ethics committee, the school provided proxy consent for parents and all participants provided informed consent.

Analysis

There were 173 adolescents who completed the survey from one school year, and no-one refused to complete the survey. Eleven cases were excluded because of large amounts of missing data (>50%), leaving responses from 162 adolescents in the analysis. Data were analysed in SPSS version 15.0. Preliminary analysis demonstrated that the data were not normally distributed, and this was resolved using logarithmic transformations. Hypothesis testing is dependent on data being normally distributed and logarithms provide a method for normalising skewed data. We have presented the nontransformed data for descriptive analysis to make the interpretation simpler, but inferential analysis used the transformed scores. Too few participants identified themselves as belonging to certain ethnic and religious groups to make statistical comparisons, and so these groups were aggregated and labelled as 'other'. Analyses of variance (ANOVAs) were performed to establish differences between groups for intention to receive the vaccine. Pearson's correlations and ANOVAs were used to explore whether the statements assessing the perceptions of meaning behind parents' HPV vaccination consent could be predicted by the variables under investigation. As there were a large number of items assessing perceptions of meaning behind parents' HPV vaccination consent, a significance level of $P < 0.01$ was used for the analysis of these items to reduce the risk of a type 1 error.

Results

The mean age of the respondents was 14.6 years (range 14–15 years). The majority described themselves as white (73%), with 11% Asian, 11% 'other' and 6% who did not respond to the ethnicity question. Christian religious denomination was the most common (55%), with 22% having no religion, 9% Muslim, 5% 'other' and 18% did not respond. Of those who reported having a religion, 24% said they were practising it (64% were not and 9% did not respond).

Most girls said that they were 'very likely' or 'likely' to have the HPV vaccination if they were offered it (91%), and 72% believed that their parents would let them have it (4% did not think their parents would let them have the vaccine, 15% were not sure and 10% did not respond). Intention to receive the vaccine was not related to age [$F(1,160) = 2.59$, $P = 0.11$], ethnicity [$F(2,150) = 0.34$, $P = 0.71$], religion [$F(3,134) = 1.84$, $P = 0.14$], whether they were practising a religion [$F(1,86) = 3.63$, $P = 0.06$] or whether they believed that their parents would let them have the vaccine [$F(2,143) = 0.32$, $P = 0.73$].

Some adolescents 'strongly agreed' or 'slightly agreed' that parental consent to vaccination implied that they were old enough to have sex (8%; Table 1) or that it was okay for them to be sexually active (10%). However, most adolescents would take positive health messages from parental consent to HPV vaccination, seeing it as indicating general approval of vaccinations (54% 'strongly agreed' or 'slightly agreed') and a desire to protect their daughter against cervical cancer (88% 'strongly agreed' or 'slightly agreed') and sexually transmitted infections (80% 'strongly agreed' or 'slightly agreed').

None of the items assessing perceptions of the meanings behind parents' HPV vaccination consent were related to whether adolescents believed their parents would consent to vaccination, nor could they be predicted by the adolescents' own intention to receive the vaccine, age, ethnicity, religion or whether they were practising a religion.

Table 1. Number and percentage of adolescents agreeing with each attitude statement and by intention (total sample $n = 162$)

Statement	Whole sample *n* (%)	Intention				Pearson's correlation
		Very unlikely *n* (%)	Unlikely *n* (%)	Likely *n* (%)	Very likely *n* (%)	
If my parents let me have the HPV vaccine, it would mean that they think that I am old enough to have sex						
Strongly disagree	32 (19.8)	0 (0)	0 (0)	14 (18.9)	18 (24.7)	$r = -0.14$, $P = 0.07$
Slightly disagree	71 (43.8)	5 (71.4)	5 (62.5)	28 (37.8)	33 (45.2)	
Unsure	47 (29.0)	1 (14.3)	2 (25.0)	26 (35.1)	18 (24.7)	
Slightly agree	9 (5.6)	0 (0)	1 (12.5)	6 (8.1)	2 (2.7)	
Strongly agree	3 (1.9)	1 (14.3)	0 (0)	0 (0)	2 (2.7)	
If my parents let me have the HPV vaccine, I would know that they think it is ok for me to be sexually active						
Strongly disagree	23 (14.2)	1 (14.3)	0 (0)	11 (14.9)	11 (15.1)	$r = -0.11$, $P = 0.15$
Slightly disagree	78 (48.1)	3 (42.9)	3 (37.5)	34 (45.9)	38 (52.1)	
Unsure	45 (27.8)	1 (14.3)	2 (25.0)	24 (32.4)	18 (24.7)	
Slightly agree	12 (7.4)	1 (14.3)	3 (37.5)	4 (5.4)	4 (5.5)	
Strongly agree	4 (2.5)	1 (14.3)	0 (0)	1 (1.4)	2 (2.7)	
If my parents let me have the HPV vaccine, it would mean that they wanted to protect me against sexually transmitted infections						
Strongly disagree	2 (1.2)	0 (0)	0 (0)	0 (0)	2 (2.7)	$r = 0.13$, $P = 0.11$
Slightly disagree	4 (2.5)	0 (0)	0 (0)	2 (2.7)	2 (2.7)	
Unsure	26 (16.0)	4 (57.1)	1 (12.5)	13 (17.6)	8 (11.0)	
Slightly agree	87 (53.7)	3 (42.9)	6 (75.0)	47 (63.5)	31 (42.5)	
Strongly agree	43 (26.5)	0 (0)	1 (12.5)	12 (16.2)	30 (41.1)	
If my parents let me have the HPV vaccine, it would mean that they wanted to protect me from cervical cancer						
Strongly disagree	2 (1.2)	0 (0)	1 (12.5)	0 (0)	1 (1.4)	$r = 0.16$, $P = 0.05$
Slightly disagree	3 (1.9)	0 (0)	0 (0)	1 (1.4)	2 (2.7)	
Unsure	14 (8.6)	1 (14.3)	0 (0)	9 (12.2)	4 (5.5)	
Slightly agree	92 (56.8)	6 (85.7)	6 (75.0)	50 (67.6)	30 (41.1)	
Strongly agree	51 (31.5)	0 (0)	1 (12.5)	14 (18.9)	36 (49.3)	
If my parents let me have the HPV vaccine, I would know that they agreed with vaccinations in general						
Strongly disagree	3 (1.9)	0 (0)	0 (0)	0 (0)	3 (4.1)	$r = 0.13$, $P = 0.09$
Slightly disagree	17 (10.5)	2 (28.6)	1 (12.5)	5 (6.8)	9 (12.3)	
Unsure	54 (33.3)	3 (42.9)	4 (50.0)	35 (47.3)	12 (16.4)	
Slightly agree	70 (43.2)	2 (28.6)	3 (37.5)	32 (43.2)	33 (45.2)	
Strongly agree	18 (11.1)	0 (0)	0 (0)	2 (2.7)	16 (21.9)	

Discussion

In this questionnaire study, we explored whether female adolescents intended to receive the HPV vaccine and whether they thought their parents would consent to them having the vaccine. We also assessed what adolescents believed their parents' HPV vaccination decisions would mean with regard to their expectations about sexual behaviour.

We found that beliefs about vaccination decisions were mostly positive, with adolescents expressing strong intentions to receive the vaccine. Most believed their parents would let them have the vaccine, and this finding is somewhat comparable with the levels of vaccine acceptance from other UK studies of parents' intentions (72% compared with 81%),[3] but lower than initial reports of actual vaccination uptake (86%).[6] The adolescents reported that they would infer fairly positive messages about vaccination and cancer prevention if their parents consented to vaccination. Almost all the adolescents agreed that being allowed the HPV vaccine meant that their parents wanted to protect them against cervical cancer and sexually transmitted infections. Most adolescents did not believe that vaccination consent implied approval for them to be sexually active. Parents concerned about negative changes in sexual behaviour following vaccination may be reassured by this.

However, some adolescents stated that they would perceive implicit approval for sexual activity if they were allowed the vaccine. These beliefs provide some confirmation of concerns previously expressed by parents,[4] indicating some support for the '*carte blanche*' concern about a change in adolescent sexual behaviour following HPV vaccination, and highlight the importance of parent–daughter communication about sex. These findings are concerning and have implications for the sexual behaviour of adolescent girls; however, caution is needed, as this was a small

study, the effect sizes were small and the predefined items might have primed the girls to agree with issues that they may not have considered previously. In addition, even if adolescents believe that sexual activity has been condoned, this does not mean that they will necessarily become sexually active. Studies of adolescents' responses to these items in alternative settings, and assessments of their freely recalled beliefs about the HPV vaccine, would be valuable.

Adolescents may benefit from talking to their parents about the HPV vaccine. Although the vaccination is being presented in the UK as a vaccination against cervical cancer, the sexually transmitted nature of the virus is referenced in information leaflets designed for adolescents. Providing parents with guidance on how to have conversations about sex with their daughters, so that they feel confident that vaccination will not influence their sexual behaviour, and helping parents explain why the vaccine is being given might be useful strategies. Furthermore, vaccination programme coordinators should ensure that information materials and campaigns highlight the reason why the vaccine is being given before the onset of sexual activity, explain that adolescents do not have to wait until they are ready to have sex before having the vaccine (as is the case with the current leaflet used by the NHS in England, Wales and Northern Ireland) and emphasise that the vaccine is protective against HPV only and not against other sexually transmitted infections.

Participants in the present study were slightly older than the cohort who will receive the vaccine as part of the standard immunisation programme; however, this age group will be included in the one-off 'catch-up' series. Girls who are already sexually active may be more liable to change their sexual behaviour following vaccination, and this older age group are more likely to have begun engaging in sexual relationships than 12–13 year olds in the main immunisation programme. Furthermore, young women who receive the vaccine as part of the routine immunisation programme will approach sexual debut knowing that they are protected against HPV, and it is important to explore what older adolescents believe about the vaccine and the protection it affords. Thus, this study examines and improves the understanding of the issues relating to sexual behaviour in an appropriate age group.

Limitations

The participants of the study attended one high-achieving secondary school, the majority were white and the sample size was small. We did not ask about the sexual status of the adolescents, which may have influenced how they responded. This limits how generalisable the results are to other British adolescents. Adolescents' intentions in the present study were assessed hypothetically; actual uptake in the UK will not be known until the end of 2009 when the first cohort has completed the vaccination course. In addition, adolescents may have inaccurate beliefs about their parents' vaccination intentions, although the findings of this study are comparable with those of studies assessing actual parental vaccination intentions.[3]

Conclusions

This study provides an insight into the beliefs of adolescent girls who are due to receive the HPV vaccine as part of the 'catch-up' programme. The majority of girls intended to be vaccinated, and would infer positive messages if their parents consented to them having the vaccination. However, a small minority of the adolescents would infer permissive messages about sexual behaviour from being allowed the vaccine. Information materials must highlight the reason why the vaccine is being given before the onset of sexual activity, and that adolescents do not have to wait until they are ready to have sex before having the vaccine.

Disclosure of interests

We have received funding or honoraria from Sanofi Pasteur MSD and GSK Biologicals, both of whom manufacture HPV vaccines.

Contribution to authorship

AF, LM and JW designed the study, AF drafted the paper and all the investigators contributed to its writing and reviewing.

Details of ethics approval

This study received ethical approval from the University College London research ethics committee (1399/001, approved 8 February 2008).

Funding

Jo Waller and Laura Marlow are supported by Cancer Research UK. Alice Forster is supported by a studentship from the University College London medical school.

Acknowledgements

We would like to thank Professor Jane Wardle for her comments on drafts of this article. ■

References

1 Walboomers JMM, Jacobs MV, Manos MM, Bosch FX, Kummer JA, Shah KV, *et al.* Human papillomavirus is a necessary cause of invasive cervical cancer worldwide. *J Pathol* 1999;189:12–9.

2 Rambout L, Hopkins L, Hutton B, Fergusson D. Prophylactic vaccination against human papillomavirus infection and disease in women: a systematic review of randomized controlled trials. *Can Med Assoc J* 2007;177:469–79.

3 Brabin L, Roberts SA, Farzaneh F, Kitchener HC. Future acceptance of adolescent human papillomavirus vaccination: a survey of parental attitudes. *Vaccine* 2006;24:3087–94.
4 Bair RM, Mays RA, Sturm LA, Zimet GD. Acceptability of the human papillomavirus vaccine among Latina mothers. *J Pediatr Adolesc Gynecol* 2008;21:329–34.
5 Waller J, Marlow LAV, Wardle J. Mothers' attitudes towards preventing cervical cancer through human papillomavirus vaccination: a qualitative study. *Cancer Epidemiol Biomarkers Prev* 2006;15:1257–61.
6 Department of Health. HPV vaccination programme: provisional data, as submitted by PCTs, for first, second and third dose vaccine uptake, for month ending 31 July 2009. 2009 [www.immunisation.nhs.uk/publications/HPV_JulyNatRegPCTdata.pdf]. Accessed 1 October 2009.

APPENDIX 11- INFORMATION MATERIALS FOR CHAPTER 6

Information Sheet
You can keep this information sheet.

Title of Project:	**Adolescent attitudes to HPV information**
This study has been approved by the UCL Research Ethics Committee [Project ID Number]:	1399/001
Name, Address and Contact Details of Investigators:	Professor Jane Wardle, Laura Marlow and Gareth Lloyd, Alice Forster Department of Epidemiology & Public Health, UCL, Brook House, 2-16 Torrington Place, WC1E 6BT

We would like to invite you to participate in this research project. You should only participate if you want to; choosing not to take part will not disadvantage you in any way. Before you decide whether you want to take part, it is important for you to read the following information carefully and discuss it with others if you wish. Ask us if there is anything that is not clear or you would like more information.

Details of Study

In this study, we are attempting to examine adolescents' reactions to health information. The session will last no longer than 45 minutes.

You will then be asked to read through an information leaflet and then answer some questions about your attitudes to what you have read. We will then give you the opportunity to ask any questions that you have about the information you have read.

At the end of the study we will give you a debriefing pack which will give you more details about the aim of the study. If you have any further questions or issues to discuss, feel free to ask the researcher at any time during the session.

It is up to you to decide whether or not to take part. If you choose not to participate it will involve no penalty or loss of benefits to which you are otherwise entitled. If you decide to take part you will be given this information sheet to keep and be asked to sign a consent form. If you decide to take part you are still free to withdraw at any time and without giving a reason. All the answers you give us will be anonymous (your name will not be on the questionnaires) and all data will be collected and stored in accordance with the Data Protection Act 1998.

Informed Consent Form

Title of Project: **Adolescent attitudes to HPV information**

This study has been approved by the UCL Research Ethics Committee [Project ID Number]: 1399/001

Participant's Statement

I ……
agree that I

- **have read the information sheet and the project has been explained to me orally;**
- **have had the opportunity to ask questions and discuss the study;**
- **have received satisfactory answers to all my questions or have been advised of an individual to contact for answers to my questions about the research;**
- **have been told that the answers I give will be anonymous and confidential and it will not be possible to identify me from any reports that the researchers write.**

I understand that I am free to withdraw from the study without penalty if I so wish and I consent to the processing of my personal information for the purposes of this study only and that it will not be used for any other purpose. I understand that such information will be treated as strictly confidential and handled in accordance with the provisions of the Data Protection Act 1998.

Signed: Date:

More about cervical cancer and screening

- In the UK there are about 2,800 cases of cervical cancer per year and 1,100 deaths
- Cervical screening (the smear test) picks up abnormal cell changes in the cervix that can lead to cervical cancer if left untreated
- Abnormal cell changes are easily treated if caught early
- Cervical screening is offered to women age 25-64 years

Where is the best place to find out more?

- Cancer Research UK
  www.cancerhelp.org.uk
- Cervical Screening (NHS)
  www.cancerscreening.nhs.uk/cervical
- Jo's Trust
  www.jotrust.co.uk
- Or talk to your doctor or practice nurse

HPV and Cervical Cancer

This leaflet was developed by researchers from the Cancer Research UK health behaviour research centre, UCL in collaboration with Sanofi Pasteur MSD

sanofi pasteur MSD
vaccines for life

THE BASICS

Cervical cancer and human papillomavirus (HPV)

- All cases of cervical cancer are associated with HPV (human papillomavirus) infection
- HPV is a virus that can infect the cells of the cervix
- The types of HPV that can cause cervical cancer do not have any symptoms
- Other types of HPV can cause genital warts

Hope for the future - HPV vaccines

- Vaccines that prevent HPV infection are now available
- The vaccines protect against 70% of cervical cancers and some vaccines will also protect against genital warts
- The vaccines are very effective
- The vaccines are most effective if given to girls before they first have sex
- The vaccines are licensed for women up to 26 years. The government will make them freely available to girls aged 12-18
- It will still be important for women to attend cervial screening when invited

More about HPV

How common is HPV?

- About 8 out of 10 women will get HPV at some point in their lives

How do you get HPV?

- HPV is a sexually transmitted infection (STI)
- HPV is transmitted through genital skin-to-skin contact (not necessarily sexual intercourse)
- Condoms give partial protection against HPV
- Men can carry the HPV virus
- In most cases, the types of HPV that cause cervical cancer do not have harmful health effects for men
- The virus can become active after a long period of being inactive and can then cause abnormal cell changes which might eventually turn into cancer

What does HPV do and can it be treated?

- The immune system usually clears HPV
- For some women, HPV will not clear by itself
- At present there is no direct treatment for HPV itself, but the abnormal cells that the virus causes can be removed very easily to prevent cancer developing
- If left untreated, persistent HPV probably takes 10-20 years to cause cervical cancer

The vaccine would be given to girls to prevent HPV infection protecting against cervical cancer

UCL

More about cervical cancer and screening

- In the UK there are about 2,800 cases of cervical cancer per year and 1,100 deaths.
- Cervical screening (the smear test) picks up abnormal cell changes in the cervix that can lead to cervical cancer if left untreated.
- Abnormal cell changes are easily treated if caught early.
- Cervical screening is offered to women age 25-64 years.

Where is the best place to find out more?

- Cancer Research UK
  www.cancerhelp.org.uk
- Cervical Screening (NHS)
  www.cancerscreening.nhs.uk/cervical
- Jo's Trust
  www.jotrust.co.uk
- Or talk to your doctor or practice nurse.

UCL

If you would like more information please contact:

Laura Marlow
Health Behaviour Unit, Department of Epidemiology & Public Health, UCL,
London WC1E 6BT
Telephone: 020 7679 1798,
Email: l.marlow@ucl.ac.uk

UCL

HPV and Cervical Cancer:

THE BASICS

UCL

Cervical cancer and human papillomavirus (HPV)

- All cases of cervical cancer are associated with HPV (human papillomavirus) infection.
- HPV is a virus that can infect the cells of the cervix.
- The types of HPV that can cause cervical cancer do not have any symptoms.
- Other types of HPV can cause genital warts.

Hope for the future -HPV vaccines

- Vaccines that prevent HPV infection are now available.
- The vaccines protect against 70% of cervical cancers and some vaccines will also protect against genital warts.
- The vaccines are very effective.
- The vaccines are most effective if given to girls before they first have sex.
- The vaccines are licensed for women up to 26 years. The government will make them freely available to girls aged 12-18.
- It will still be important for women to attend cervical screening when invited.

UCL

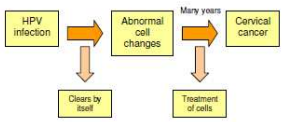
More about HPV

How common is HPV?

- About 8 out of 10 women will get HPV at some point in their lives.

How do you get HPV?

- HPV is a sexually transmitted infection (STI).
- HPV is transmitted through genital skin-to-skin contact (not necessarily sexual intercourse).
- Condoms give partial protection against HPV.
- Men can carry the HPV virus.
- In most cases, the types of HPV that cause cervical cancer do not have harmful health effects for men.
- The virus can become active after a long period of being inactive and can then cause abnormal cell changes which might eventually turn into cancer.



UCL

What does HPV do and can it be treated?

- In 9 out of 10 women the immune system clears HPV.
- For some women, HPV will not clear by itself.
- At present there is no direct treatment for HPV itself, but the abnormal cells that the virus causes can be removed very easily to prevent cancer developing.
- If left untreated, persistent HPV probably takes 10-20 years to cause cervical cancer.

The vaccine would be given to girls to prevent HPV infection, protecting against cervical cancer.

APPENDIX 12 – MEASURES FOR CHAPTER 6

Questionnaire booklet

This booklet contains some questions about:

Your views about HPV
Your parents' views about HPV
You

It should take about 30 minutes to complete.

When the entire group has finished the researcher will collect the questionnaires.

Your knowledge of HPV

Please answer the following questions about HPV. Don't worry if you are not sure about the answers or the terms used! Just answer to the best of your ability.

Please read each of the statements about HPV and indicate whether they are true or false by ticking (✓) the appropriate box.

	True	False	Not Sure
HPV often has no visible signs or symptoms	☐	☐	☐
Having many sexual partners increases the risk of getting HPV	☐	☐	☐
HPV always causes genital warts	☐	☐	☐
HPV is related to the AIDS virus	☐	☐	☐
HPV can be transmitted during sexual intercourse	☐	☐	☐
HPV can be treated with antibiotics	☐	☐	☐
HPV is very rare	☐	☐	☐
HPV can cause cervical cancer (cancer of the neck of the womb)	☐	☐	☐
HPV usually goes away without needing any treatment	☐	☐	☐
Most sexually active people will get HPV at some point in their lives	☐	☐	☐
A person always knows if they have HPV	☐	☐	☐
A person could have HPV for many years without knowing it	☐	☐	☐
Men cannot get HPV	☐	☐	☐
If you receive the HPV vaccine you no longer have to go to have a smear test	☐	☐	☐
The HPV vaccine is most effective if given to girls before they first have sex	☐	☐	☐
The HPV vaccine will be available on the NHS for 12-13 year old girls	☐	☐	☐
The HPV vaccine protects against all types of cancer	☐	☐	☐
Some HPV vaccines protect against genital warts	☐	☐	☐

In the future girls aged 12-18 years will be offered a vaccination to prevent HPV infection.

When you are invited to have the HPV vaccination, how likely would you be to have it?

Very unlikely	Unlikely	Likely	Very likely
☐	☐	☐	☐

About your parents ….

Imagine you are offered the HPV vaccine this year.

How much do you agree with the following statements?

EXAMPLE	Strongly disagree	Slightly disagree	Neither disagree nor agree	Slightly agree	Strongly agree
If my parents let me have the HPV vaccine they would be acknowledging that I will have sex one day	☐	☐	☐	☐	☐

	Strongly disagree	Slightly disagree	Neither disagree nor agree	Slightly agree	Strongly agree
If my parents let me have the HPV vaccine they would be concerned that I might have sex earlier	☐	☐	☐	☐	☐
If my parents let me have the HPV vaccine they would be concerned that I might have unprotected sex	☐	☐	☐	☐	☐
If my parents let me have the HPV vaccine it would mean that they wanted to protect me against sexually transmitted infections	☐	☐	☐	☐	☐
If my parents let me have the HPV vaccine it would mean that they wanted to protect me from cervical cancer	☐	☐	☐	☐	☐
If my parents let me have the HPV vaccine it would mean that they think that I am old enough to have sex	☐	☐	☐	☐	☐
If my parents let me have the HPV vaccine I would know that they agreed with vaccinations in general	☐	☐	☐	☐	☐
If my parents let me have the HPV vaccine I would know that they think it is ok for me to be sexually active	☐	☐	☐	☐	☐

In general, do you think that your parents would let you have the HPV vaccine?		
Yes	No	Not Sure
☐	☐	☐

And a few questions about you ….

What is your age today? …….

Ethnic group (please tick one box):

☐ White (British or other)	☐ Asian or Asian British (Pakistani)
☐ Black or Black British (African)	☐ Asian or Asian British (Other)
☐ Black or Black British (Caribbean)	☐ Chinese
☐ Black or Black British (Other)	☐ Mixed (please state) …….
☐ Asian or Asian British (Indian)	☐ Other (please state) ……
☐ Asian or Asian British (Bangladeshi)	☐ Do not wish to answer

What religion are you? (Please state) ……

Would you say you are practicing this religion? Yes ☐ No ☐

APPENDIX 13- ETHICAL APPROVAL FOR CHAPTER 6

UCL GRADUATE SCHOOL
UCL RESEARCH ETHICS COMMITTEE

Professor Jane Wardle
Department of Epidemiology and Public Health
UCL, Brook House
2-16 Torrington Place

08 February 2008

Dear Professor Wardle

Notification of Ethical Approval
Project ID/Title: 1399/001: Young women and human papillomavirus vaccination

I am pleased to confirm that I have approved the above research proposal for the duration of the study i.e. until February 2009. Approval is subject to the following conditions:

1. You must seek Chair's approval for proposed amendments to the research for which this approval has been given. Ethical approval is specific to this project and must not be treated as applicable to research of a similar nature. Each research project is reviewed separately and if there are significant changes to the research protocol you should seek confirmation of continued ethical approval by completing the 'Amendment Approval Request Form'.

The form identified above can be accessed by logging on to the ethics website homepage: http://www.grad.ucl.ac.uk/ethics/ and clicking on the button marked 'Responsibilities Following Approval'.

2. It is your responsibility to report to the Committee any unanticipated problems or adverse events involving risks to participants or others. Both non-serious and serious adverse events must be reported.

   Reporting Non-Serious Adverse Events.
   For non-serious adverse events you will need to inform Ms Helen Dougal, Ethics Committee Administrator (h.dougal@ucl.ac.uk), within ten days of an adverse incident occurring and provide a full written report that should include any amendments to the participant information sheet and study protocol. The Chair or Vice-Chair of the Ethics Committee will confirm that the incident is non-serious and report to the Committee at the next meeting. The final view of the Committee will be communicated to you.

   Reporting Serious Adverse Events
   The Ethics Committee should be notified of all serious adverse events via the Ethics Committee Administrator immediately the incident occurs. Where the adverse incident is unexpected and serious, the Chair or Vice-Chair will decide whether the study should be terminated pending the opinion of an independent expert. The adverse event will be considered at the next Committee meeting and a decision will be made on the need to change the information leaflet and/or study protocol.

On completion of the research you must submit a brief report (a maximum of two sides of A4) of your findings/concluding comments to the Committee, which includes in particular issues relating to the ethical implications of the research.

Yours sincerely

Sir John Birch
Chair of the UCL Research Ethics Committee

Cc: Miss Alice Forster and Dr Jo Waller, Department of Epidemiology & Public Health, UCL

APPENDIX 14 – FINDINGS FOR CHAPTER 6

Percentage of missing responses from original dataset

	Percentage of missing responses
Age	7.4
Knowledge	11.7
If you were invited to have the HPV vaccination, how likely would you be to have it?	5.6
Beliefs about sexual behaviour	
If my parents let me have the HPV vaccine they would be concerned that I might have sex earlier	6.8
If my parents let me have the HPV vaccine they would be concerned that I might have unprotected sex	6.8
If my parents let me have the HPV vaccine it would mean that they think that I am old enough to have sex	7.4
If my parents let me have the HPV vaccine I would know that they think it is ok for me to be sexually active	8.0
Beliefs about other issues relating to HPV vaccination	
If my parents let me have the HPV vaccine it would mean that they wanted to protect me against sexually transmitted infections	8.6
If my parents let me have the HPV vaccine it would mean that they wanted to protect me from cervical cancer	8.6
If my parents let me have the HPV vaccine I would know that they agreed with vaccinations in general	8.0

Testing relationships between continuous and categorical independent variables – Age

		n	Mean	SD	t
Knowledge	14	66	1.06	0.27	t(160)=-.79, p=.43
	15	96	1.09	0.19	

Testing differences between categorical independent variables – Age

	14 n (%)	15 n (%)	Total n (%)	χ^2
Ethnicity				
White	53 (82.8)	65 (73.0)	118 (77.1)	χ^2 (2)=1.98, p=.38
Asian	6 (9.4)	12 (13.5)	18 (11.8)	
Other	5 (7.8)	12 (13.5)	17 (11.1)	
Total	64 (100)	89 (100)	153 (100)	
Religion				
None	40 (22)	19 (22.9)	41 (29.7)	
Christian	26 (47.3)	48 (57.8)	74 (53.6)	χ^2 (2)=1.98, p=.38
Muslim	4 (7.3)	11 (13.3)	15 (10.9)	
Other	3 (5.5)	5 (6.0)	8 (5.8)	
Total	55 (100)	100 (83)	138 (100)	
Would you say that you are practicing this religion?				
Yes	7 (23.3)	19 (32.8)	26 (29.5)	χ^2 (1)=.83, p=.36
No	23 (76.7)	39 (67.2)	62 (70.5)	
Total	30 (100)	58 (100)	88 (100)	

Testing differences between categorical and continuous independent variables – Ethnicity

		n	Mean	SD	F(ANOVA)
Knowledge	White	118	1.07	.23	F(2,150)=1.06, p=.35
	Asian	18	1.12	.08	
	Other	17	1.01	.31	
	Total	153	1.07	.23	

Significant differences between categorical independent variables – ethnicity

	White n (%)	Asian n (%)	Other n (%)	Total n (%)	p
Religion					<.01
None	38 (36.5)	1 (6.7)	0 (0)	39 (29.3)	
Christian	65 (62.5)	0 (0)	8 (57.1)	73 (54.9)	
Muslim	0 (0)	8 (53.3)	5 (35.7)	13 (9.8)	
Other	1 (1.0)	6 (40.0)	1 (7.1)	8 (6.0)	
Total	104 (100)	15 (100)	14 (100)	133 (100)	
Would you say you are practicing this religion?					<.01
Yes	10 (16.9)	8 (57.1)	8 (61.5)	26 (30.2)	
No	49 (83.1)	6 (42.9)	5 (38.5)	60 (69.8)	
Total	59 (100)	14 (100)	13 (100)	86 (100)	

Table 6.6 – Significant differences between categorical independent variables – religion

	None n (%)	Christian n (%)	Muslim n (%)	Other n (%)	Total n (%)	p
Would you say you are practicing this religion?						.01
Yes	-	14 (21.2)	7 (50.0)	5 (62.5)	26 (29.5)	
No	-	52 (78.8)	7 (50.0)	3 (37.5)	62 (70.5)	
Total	-	66 (100)	14 (100)	8 (100)	88 (100)	

Testing differences between categorical and continuous independent variables – Knowledge

	n	Mean	SD	F(ANOVA)
Religion				
None	41	1.11	.14	F(3,134)=.69, p=.56
Christian	74	1.06	.25	
Muslim	15	1.04	.31	
Other	8	1.07	.12	
Would you say that you are practicing that religion				F(1,86)=1.82, p=.18
Yes	26	1.01	.32	
No	62	1.08	.19	

Testing differences between the girls' own intention to receive the HPV vaccine and whether they believed their parents would let them have the vaccine.

	n	Mean	SD	F (ANOVA)
In general, do you think that your parents would let you have the HPV vaccine?				F(2,143)=.32, p=.72
Yes	116	0.51	0.12	
No	6	0.48	0.15	
Not sure	24	0.52	0.14	

Testing differences between the girls' own intention to receive the HPV vaccine and ethnicity, religion and practicing a religion

	n	Mean	SE	F (ANCOVA)
Ethnicity				F=.52, p=.6
White	59	0.47	0.06	
Asian	14	0.47	0.04	
Other	13	0.48	0.05	
Religion				F=.91, p=.41
Christian	65	0.49	0.03	
Muslim	13	0.44	0.05	
Other	8	0.5	0.07	
Practicing this religion				F=2.5, p=.12
Yes	26	0.45	0.04	
No	60	0.51	0.04	

Testing differences between the girls' own intention to receive the HPV vaccine and age

	Age	n	Mean	SD	t
Vaccine intention	14	66	0.52	0.10	t(160)=1.61,
	15	96	0.49	0.15	p=1.1

Testing differences between the girls' beliefs about whether their parents will let them have the HPV vaccine and religion

	None n (%)	Christian n (%)	Muslim n (%)	Other n (%)	Total n (%)	χ^2
In general, do you think your parents will let you have the HPV vaccine?						$\chi^2(6)=9.26$, p=.10
Yes	35 (87.5)	58 (84.1)	6 (60)	5 (62.5)	104 (81.9)	
No	0 (0)	3 (4.3)	1 (10)	1 (2.5)	5 (3.9)	
Not sure	5 (12.5)	8 (11.6)	3 (30)	2 (25)	18 (14.2)	
Total	40 (100)	69 (100)	10 (100)	8 (100)	127 (100)	

Testing differences between the girls' beliefs about whether their parents will let them have the HPV vaccine and categorical independent variables

	Odds ratio	95% confidence interval	P value for within variable comparisons	P value for contribution to the model [a]
Religion				.47
None	-	-	-	
Christian	3.83	.33-44.55	.28	
Muslim	.91	.13-6.56	.93	
Other	-	-	-	
Ethnicity				.77
White	-	-	-	
Asian	1.08	.08-13.76	.95	
Other	.57	.07-4.31	.58	
Practicing a religion				.47
Yes	-	-	-	
No	1.65	.44-6.27	.74	
Not religious	5.50	.33-91.61	1.19	

[a] Pseudo R^2=.06, N=118

Testing differences between the girls' beliefs about whether their parents will let them have the HPV vaccine and age

	14 n (%)	15 n (%)	Total n (%)	χ^2
Will your parents let you have the vaccine?				
Yes	48 (76.2)	68 (81.9)	116 (79.5)	$\chi^2(2)=.32$, p=1.0
No	2 (3.2)	4 (4.8)	6 (4.1)	
Not Sure	13 (20.6)	11 (13.3)	24 (16.4)	
Total	63 (100)	83 (100)	146 (100)	

Testing differences between the girls' beliefs about whether their parents will let them have the HPV vaccine and knowledge

	n	Mean	SD	F (ANOVA)
In general, do you think that your parents would let you have the HPV vaccine?				
Yes	116	1.09	0.19	F(2,143)=.61, p=.54
No	6	0.99	0.17	
Not sure	24	1.09	0.25	

Differences between the statements about the girls' perceptions of the meanings behind their parents' vaccination consent and age

Age		n	Mean	SD	t
If my parents let me have the HPV vaccine they would be concerned that I might have sex earlier	14	66	0.30	0.23	t(160)=-1.69, p=.09
	15	96	0.36	0.21	
If my parents let me have the HPV vaccine they would be concerned that I might have unprotected sex	14	66	0.31	0.22	t(160)=-1.22, p=.22
	15	96	0.35	0.20	
If my parents let me have the HPV vaccine it would mean that they wanted to protect me against sexually transmitted infections	14	66	0.59	0.11	t(160)=-.22, p=.83
	15	96	0.59	0.11	
If my parents let me have the HPV vaccine it would mean that they wanted to protect me from cervical cancer	14	66	0.61	0.08	t(160)=.57, p=.57
	15	96	0.61	0.11	
If my parents let me have the HPV vaccine it would mean that they think that I am old enough to have sex	14	66	0.32	0.19	t(160)=.26, p=.8
	15	96	0.31	0.19	
If my parents let me have the HPV vaccine I would know that they agreed with vaccinations in general	14	66	0.55	0.12	t(160)=1.41, p=.16
	15	96	0.52	0.14	
If my parents let me have the HPV vaccine I would know that they think it is ok for me to be sexually active	14	66	0.33	0.19	t(160)=-.72, p=.47

Relationships between the statements about the girls' perceptions of the meanings behind their parents' vaccination consent and knowledge

(N=162)	Pearson Correlation	Sig. (2-tailed)
If my parents let me have the HPV vaccine they would be concerned that I might have sex earlier	-.12	0.11
If my parents let me have the HPV vaccine it would mean that they think that I am old enough to have sex	-.13	0.09
If my parents let me have the HPV vaccine I would know that they agreed with vaccinations in general	.05	0.49
If my parents let me have the HPV vaccine I would know that they think it is ok for me to be sexually active	-.11	0.16

Relationships between the statements about the girls' perceptions of the meanings behind their parents' vaccination consent and the girls' own HPV vaccination intentions

(N=162)	Pearson Correlation	Sig. (2-tailed)
If my parents let me have the HPV vaccine they would be concerned that I might have sex earlier	-.11	0.16
If my parents let me have the HPV vaccine they would be concerned that I might have unprotected sex	-.06	0.44
If my parents let me have the HPV vaccine it would mean that they wanted to protect me from cervical cancer	.09	0.26
If my parents let me have the HPV vaccine I would know that they agreed with vaccinations in general	.13	0.11
If my parents let me have the HPV vaccine I would know that they think it is ok for me to be sexually active	.16	0.05
If my parents let me have the HPV vaccine it would mean that they wanted to protect me against sexually transmitted infections	-.14	0.07

Differences between the statements about the girls' perceptions of the meanings behind their parents' vaccination consent and ethnicity

Ethnicity	n	Adjusted mean	SE	F (ANCOVA)
If my parents let me have the HPV vaccine they would be concerned that I might have sex earlier				F=.59, p=.39
White	59	.29	.03	
Asian	14	.40	.09	
Other	13	.39	.06	
If my parents let me have the HPV vaccine they would be concerned that I might have unprotected sex				F=.23, p=.79
White	59	.3	.03	
Asian	14	.29	.09	
Other	13	.34	.06	
If my parents let me have the HPV vaccine it would mean that they wanted to protect me against sexually transmitted infections				F=.09, p=.91
White	59	.59	.02	
Asian	14	.57	.04	
Other	13	.59	.03	
If my parents let me have the HPV vaccine it would mean that they wanted to protect me against cervical cancer				F=.19, p=.82
White	59	.61	.02	
Asian	14	.59	.04	
Other	13	.59	.03	
If my parents let me have the HPV vaccine it would mean that they think that I am old enough to have sex				F=.2, p=.82
White	59	.32	.03	
Asian	14	.31	.08	
Other	13	.35	.06	
If my parents let me have the HPV vaccine I would know that they agreed with vaccinations in general				F=.4, p=.67
White	59	.5	.02	
Asian	14	.51	.06	
Other	13	.54	.04	
If my parents let me have the HPV vaccine I would know that they think it is ok for me to be sexually active				F=.61, p=.54
White	59	.34	.03	
Asian	14	.36	.07	
Other	13	.4	.05	

Differences between the statements about the girls' perceptions of the meanings behind their parents' vaccination consent and religion

Religion	n	Adjusted mean	SE	F (ANCOVA)
If my parents let me have the HPV vaccine they would be concerned that I might have sex earlier				F=.42, p=.65
Christian	65	.34	.03	
Muslim	13	.3	.07	
Other	8	.27	.08	
If my parents let me have the HPV vaccine they would be concerned that I might have unprotected sex				F=1.28, p=.28
Christian	65	.33	.03	
Muslim	13	.22	.07	
Other	8	.23	.08	
If my parents let me have the HPV vaccine it would mean that they wanted to protect me against sexually transmitted infections				F=1.22, p=.3
Christian	65	.6	.01	
Muslim	13	.58	.04	
Other	8	.53	.04	
If my parents let me have the HPV vaccine it would mean that they wanted to protect me against cervical cancer				F<.01, p=1.0
Christian	65	.61	.01	
Muslim	13	.61	.03	
Other	8	.61	.04	
If my parents let me have the HPV vaccine it would mean that they think that I am old enough to have sex				F=.22, p=.8
Christian	65	.33	.03	
Muslim	13	.3	.06	
Other	8	.28	.07	
If my parents let me have the HPV vaccine I would know that they agreed with vaccinations in general				F=1.42, p=.25
Christian	65	.52	.02	
Muslim	13	.53	.04	
Other	8	.44	.05	
If my parents let me have the HPV vaccine I would know that they think it is ok for me to be sexually active				F=.89, p=.42
Christian	65	.35	.02	
Muslim	13	.37	.06	
Other	8	.28	.06	

Differences between the statements about the girls' perceptions of the meanings behind their parents' vaccination consent and practicing a religion

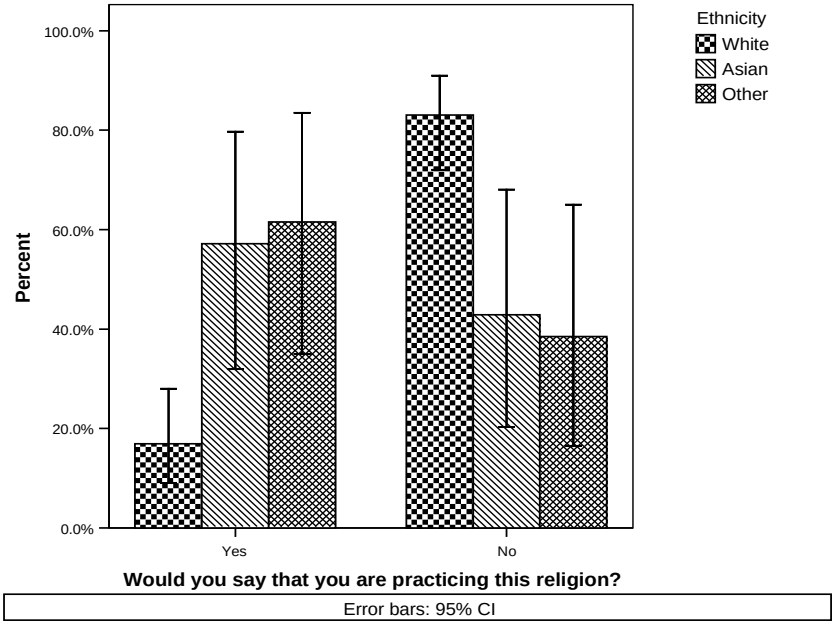
Practicing a religion	n	Adjusted mean	SE	F (ANCOVA)
If my parents let me have the HPV vaccine it would mean that they wanted to protect me against sexually transmitted infections				F<.01, p=.94
Yes	26	.59	.02	
No	60	.59	.01	
If my parents let me have the HPV vaccine it would mean that they wanted to protect me against cervical cancer				F=.16, p=.69
Yes	26	.6	.02	
No	60	.61	.01	
If my parents let me have the HPV vaccine it would mean that they think that I am old enough to have sex				F=1.68, p=.2
Yes	26	.37	.04	
No	60	.3	.03	
If my parents let me have the HPV vaccine I would know that they agreed with vaccinations in general				F=.04, p=.85
Yes	26	.52	.03	
No	60	.51	.02	
If my parents let me have the HPV vaccine I would know that they think it is ok for me to be sexually active				F=.05, p=.83
Yes	26	.34	.04	
No	60	.35	.02	

Differences between the statements about the girls' perceptions of the meanings behind their parents' vaccination consent and the girls' beliefs about whether their parents would consent to HPV vaccination

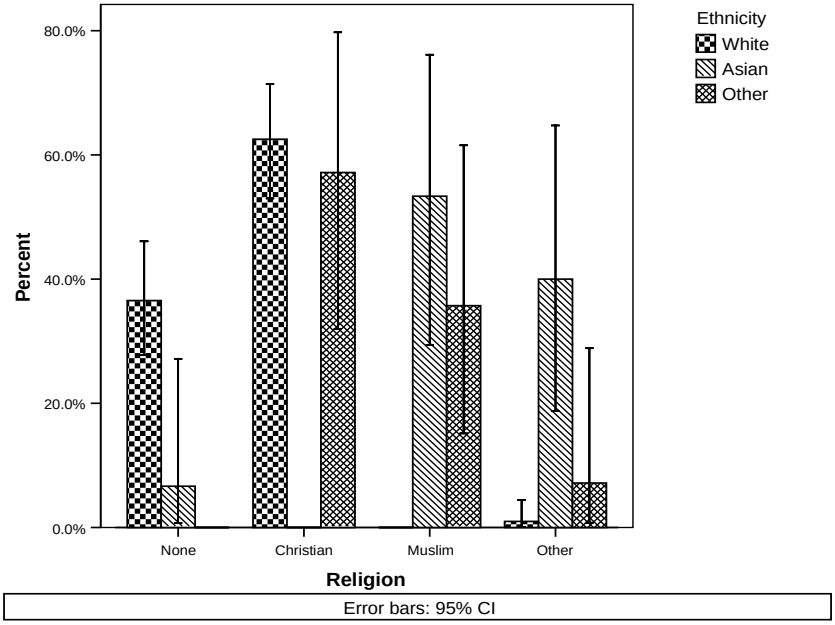
	n	Mean	SD	F (ANOVA)
If my parents let me have the HPV vaccine they would be concerned that I might have sex earlier				F(2,143)=.03, p=.98
No	6	0.34	0.19	
Not sure	24	0.33	0.26	
Yes	116	0.32	0.21	
If my parents let me have the HPV vaccine they would be concerned that I might have unprotected sex				F(2,143)=.68, p=.51
No	6	0.35	0.23	
Not sure	24	0.38	0.24	
Yes	116	0.32	0.21	
If my parents let me have the HPV vaccine it would mean that they wanted to protect me against sexually transmitted infections				F(2,143)=1.59, p=.21
No	6	0.60	0.07	
Not sure	24	0.61	0.06	
Yes	116	0.59	0.12	
If my parents let me have the HPV vaccine it would mean that they wanted to protect me against cervical cancer				F(2,143)=2.21, p=.11
No	6	0.53	0.27	
Not sure	24	0.62	0.07	
Yes	116	0.61	0.08	
If my parents let me have the HPV vaccine it would mean that they think that I am old enough to have sex				F(2,143)=.74, p=.48
No	6	0.28	0.25	
Not sure	24	0.28	0.18	
Yes	116	0.32	0.18	
If my parents let me have the HPV vaccine I would know that they agreed with vaccinations in general				F(2,143)=.59, p=.56
No	6	0.48	0.16	
Not sure	24	0.53	0.11	
Yes	116	0.53	0.13	
If my parents let me have the HPV vaccine I would know that they think it is ok for me to be sexually active				F(2,143)=2.97, p=.06
No	6	0.44	0.12	
Not sure	24	0.27	0.20	
Yes	116	0.35	0.18	

APPENDIX 15 - GRAPHS FOR CHAPTER 6

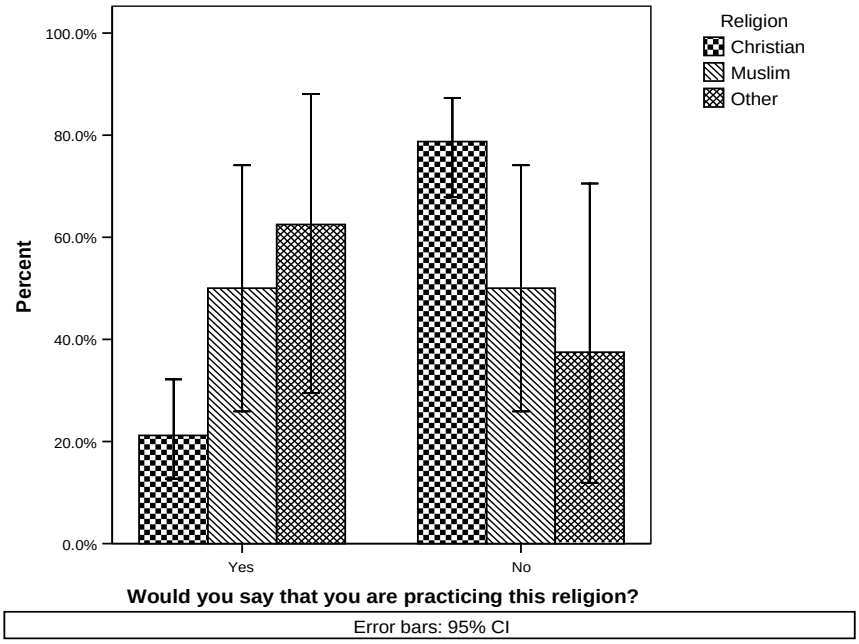
Bar graph for practicing a religion grouped by ethnicity



Bar graph for religion grouped by ethnicity



Bar graph for practicing a religion grouped by religion



APPENDIX 16 – CHAPTER 7 INFORMATION SHEET AND CONSENT FORM

UCL DEPARTMENT OF EPIDEMIOLOGY AND PUBLIC HEALTH
CANCER RESEARCH UK HEALTH BEHAVIOUR RESEARCH CENTRE

"The HPV vaccination and you!"

We would like to invite you to take part in a research study. Before you decide whether you would like take part you need to understand why the research is being done and what it would involve for you. Please take time to read the following information carefully. Talk to others about the study if you wish. Ask us if there is anything that is not clear or if you would like more information. Take time to decide whether or not you wish to take part.

Why is this study being done?
The human papillomavirus vaccination has recently been introduced into the childhood immunisation programme. You will be invited to receive this vaccination in the next academic year. We would like to know what girls like you think about the vaccination and to understand why some girls do not want the vaccine. The project is part of a doctoral thesis.

Why me?
Your college/sixth form has agreed to take part in the research and we are inviting all girls in year 12. There will be around 1700 girls asked to take part in this project, including girls from other sixth forms/colleges.

Do I have to take part?
It is up to you to decide. We will describe the study in this information sheet. We will then ask you to sign a consent form to show you have agreed to take part. You are free to leave the study whenever you want, without giving a reason.

What will I have to do?
If you agree to take part we will ask you to complete 3 questionnaires. The first will be completed in the next week, the second in 6 months time and the third in 12 months time. Each questionnaire will take a maximum of 30 minutes to complete.

What are the possible benefits and disadvantages of taking part?
The questionnaire will be completed during the school day so you may miss out on your usual tutorial lesson, but we hope that you will find completing the questionnaires interesting. We will try to help your teachers make your tutorial sessions more appropriate to your class using the results of the study, although we will never tell your teachers what you personally

have said. We cannot promise the study will help you, but the information we get may go towards helping us understand issues about HPV that are important to girls like you.

Will my responses be anonymous?
Yes. We will store, process, handle and destroy any information you give us in accordance with the Data Protection Act (1998). It will not be possible to match your name to any information that you give in the questionnaire. The only people who will have access to the information will be myself and Alice Forster.

What will happen if I don't want to be part of the study anymore?
If you decide that you no longer want to be part of the study you can contact us and all information that you have given to us will be destroyed.

What will happen to the results?
The results of the study will be published in an academic journal and will be written as part of a doctoral thesis. We will provide your college/sixth form with a final report of the research which they may wish to give to you.

What happens if there is a problem?
This study has been approved by an independent group of people called the University College London Ethics Committee. If you have any worries or questions about this study, you should speak Alice Forster:

Cancer Research UK Health Behaviour Research Centre
University College London
1-19 Torrington Place
London
WC1E 7HN

020 7679 1723
a.forster@ucl.ac.uk

Thank you for considering this project,

Professor Jane Wardle and Alice Forster

Department of Epidemiology and Public Health
Cancer Research UK Health Behaviour Research Centre

Informed Consent Form for Participants in Research Studies

(This form is to be completed independently by the participant after reading the Information Sheet and/or having listened to an explanation about the research.)

Title of Project: "The HPV vaccination and you!"

This study has been approved by the UCL Research Ethics Committee: 1399/003

Participant's Statement

I.....

agree that I

- **have read the information sheet and/or the project has been explained to me orally;**
- **have had the opportunity to ask questions and discuss the study;**
- **have received satisfactory answers to all my questions or have been advised of an individual to contact for answers to pertinent questions about the research and my rights as a participant and whom to contact in the event of a research-related injury.**
- **have been told that confidentiality and anonymity will be maintained and it will not be possible to identify me from any publications.**

I understand that I am free to withdraw from the study without penalty if I so wish and I consent to the processing of my personal information for the purposes of this study only and that it will not be used for any other purpose. I understand that such information will be treated as strictly confidential and handled in accordance with the provisions of the Data Protection Act 1998.

Signed: Date:

....

Department of Epidemiology and Public Health
Cancer Research UK Health Behaviour Research Centre

YOUNG WOMEN'S PARTICIPATION IN THE HUMAN PAPILLOMAVIRUS IMMUNISATION PROGRAMME: "THE HPV VACCINATION AND YOU!"

Research summary

We would like to learn what young women think about the HPV vaccination to prevent cervical cancer, why some decide not to get the vaccine and other issues that surround its implementation. We would like year 12 girls in the academic year 2008/2009 to complete a questionnaire 3 times (in March 2009, September 2009 and in March 2010 when they are in year 13). We would also like year 12 girls in the academic year 2009/2010 to complete a questionnaire 2 times (in September 2009 and March 2010). We've tested the questionnaire on other year 12 girls before and have found that the questionnaire takes about 30 minutes to complete.

Why is this study being done?

Human papillomavirus (HPV) is a common sexually transmitted infection (STI) and infection with the virus has been found to be essential in the development of cervical cancer. Three-dose preventative vaccines have been developed to protect against the two most common cancer-causing HPV types (16 and 18) which cause 70% of cervical cancers and have been introduced into the childhood immunisation programme in the UK for all 12-13 year old girls. A one-off catch-up programme has additionally been introduced that will ensure that all girls who are currently 18 years old or younger will be offered the vaccine.

Parents are generally positive about the vaccine. To ensure that vaccination uptake is optimal, it is important to establish the groups of people who are not receiving the vaccine and the reasons for this. Most of this research has been conducted with parents and adults, rather than the adolescents themselves. It is particularly important to conduct this research with older adolescents as they will not require parental consent to receive the vaccine.

Parents hold consistent concerns about the vaccine. Primarily these are regarding the safety and efficacy of the vaccine. However, a significant minority of parents are also concerned that because HPV is sexually transmitted their daughters may interpret parental vaccination

consent as providing tacit consent for them to be sexually active. There are also concerns that adolescents will perceive that protection from a STI means that they are less at risk of contracting other STIs.

Since the vaccine has only recently been introduced into the immunisation schedule (September 2008) it not yet known how participation in the HPV immunisation programme will affect girls and whether these concerns are valid. Additionally, research conducted prior to the introduction of the vaccine measured vaccination uptake intention, rather that actual vaccination uptake. We do not know whether the same people who do not intend to get the vaccine actually do not get the vaccine.

What are the objectives of the study?

This study aims to address these unknown questions by examining issue that are important to 16-17 year old girls who are eligible for HPV immunisation.

There are 3 main research questions:

1. Does HPV vaccination have an effect on girls' attitudes to sexual behaviour, beliefs about cervical cancer prevention and actual behaviour?
2. What factors are associated with HPV vaccination uptake?
    - Are girls who decline the vaccine at a lower or higher risk of cervical cancer?
    - Are girls who decline the vaccine also less likely to attend cervical screening?
3. What reasons do girls give for not receiving the HPV vaccine?

The procedure on the day

One week before data collection researchers will attend a tutorial session to explain the research to the girls and to provide them with a copy of the information sheet to take away.

On the day of data collection researchers will arrive at a time agreed with the college to set up and prepare for data collection with the girls. For the questionnaire completion, female students will be in a separate room from any male students and seated at desks that are far enough apart that the girls feel confident that no other person can see their responses. The study will only survey female students. The teacher can remain in the room if they wish; some research suggests that students provide more honest answers if teachers are not present.

All girls will read the information sheet and once any questions have been answered they will provide informed consent if they agree to take part in the study. Girls will then complete the questionnaire. A word search is provided at the end of the questionnaire for early finishers to occupy their time and to prevent them from distracting others or looking at their responses. Once the questionnaire has been completed the girls will put their completed forms into an unmarked envelope to ensure confidentiality. The questionnaire has been piloted and takes around 30 minutes to complete.

Once all envelopes have been collected the researchers will answer any questions that the girls may have and the data collection for that day will be complete. The researchers will need an area to collate the questionnaires at the end of collection.

Ethical Guidelines

This study has received approval from the University College London ethics committee. This means that an independent committee has agreed that this study:

- Will be carried out safely and will respect autonomy and privacy of respondents
- Is based on valid science and will advance knowledge
- Has weighed the benefits of the individual with the risks
- Has not been corrupted by political or commercial influence
- Meets the requirements of the law including data protection and criminal records check
- Will adhere to principles of distributive justice and the Declaration of Helsinki

If you have a concern about any aspect of this study, you should ask to speak to Alice Forster.

APPENDIX 17 – QUESTIONNAIRES USED AT EACH TIME POINT

BASELINE QUESTIONNAIRE – TIME 1 Participant number .....

Department of Epidemiology and Public Health
Cancer Research UK Health Behaviour Research Centre

The HPV vaccination and you!

Questionnaire booklet: YOUNG WOMEN

This booklet contains some questions about:

- Vaccinations
- Cervical cancer, HPV and cervical screening
- Sexual health
- You

It should take about 30 minutes to complete. At times you will be asked to read some information before answering the questions.

Remember, this questionnaire is completely confidential. You don't need to write your name on it. We will not show your responses to your teachers, parents or anyone who knows you.

When the entire group has finished please put the questionnaire back into the envelope. The researcher will collect the envelopes.

The questions below will help us match up your questionnaires from year to year without us knowing anything personal about you like your name.

What is your date of birth?	Day	Month	Year
	……	……..	…….
What is your postcode?	……		

How you feel about vaccinations (sometimes called immunisations or injections) Please tick (✓) one box only for each statement

	Definitely not	Probably not	Not sure	Yes, probably	Yes, definitely
Do you think that vaccinations are necessary to prevent certain diseases?	☐	☐	☐	☐	☐
Do you think that it is important to have vaccinations?	☐	☐	☐	☐	☐
Do you think that vaccinations in general are safe?	☐	☐	☐	☐	☐
	Not at all scared	Not very scared	Not sure	Quite scared	Very scared
Are you scared of needles?	☐	☐	☐	☐	☐
	Not at all concerned	Not very concerned	Not sure	Quite concerned	Very concerned
Are you concerned that vaccinations are given to prevent diseases that are not serious?	☐	☐	☐	☐	☐

PLEASE READ THIS BEFORE YOU ANSWER THE NEXT QUESTIONS

Human papillomavirus (HPV) is a very common infection involved in most cervical cancers. It is transmitted via skin-to-skin contact, most commonly during sexual activity. A vaccine has been developed that protects against this infection. Next school year you will be offered the HPV vaccine.

Please make sure you've read the information above before answering the next questions

	Yes	No
Have you already received the HPV vaccine?	☐	☐

How you feel about HPV vaccination
Please tick (✓) one box only for each statement

	Strongly disagree	Disagree	Not sure	Agree	Strongly agree
I will try to have the HPV vaccine	☐	☐	☐	☐	☐

	Strongly disagree	Disagree	Not sure	Agree	Strongly agree
I intend to have the HPV vaccine	☐	☐	☐	☐	☐

Please try and explain your reasons:

.....

.....

	Strongly disagree	Disagree	Not sure	Agree	Strongly agree
My parents will let me have the HPV vaccine	☐	☐	☐	☐	☐

Please try and explain your reasons:

.....

.....

Why do you think young women in your year at college might choose to not have the vaccine? (Please write):

.....

.....

Why do you think parents of young women in your year at college might not want their daughters to have the vaccine? (Please write):

.....

.....

What your friends and family think you should do when you are offered the HPV vaccine

	Strongly disagree	Disagree	Not sure	Agree	Strongly agree
My friends will think I should have the HPV vaccine	☐	☐	☐	☐	☐
My parents will think I should have the HPV vaccine	☐	☐	☐	☐	☐
My parents will think that I will have more sex if I have the HPV vaccine	☐	☐	☐	☐	☐

	Strongly disagree	Disagree	Not sure	Agree	Strongly agree
My parents will think that I will use condoms less often when I have sex if I have the HPV vaccine	☐	☐	☐	☐	☐
My parents will think that I will have sex with more people if I have the HPV vaccine	☐	☐	☐	☐	☐

What you think about the HPV vaccine

	Definitely not	Probably not	Not sure	Yes, probably	Yes, definitely
Do you think that the HPV vaccine is effective in preventing cervical cancer?	☐	☐	☐	☐	☐
Do you think that the HPV vaccine is effective in preventing HPV infection?	☐	☐	☐	☐	☐
Do you think that the HPV vaccine is effective in preventing sexually transmitted infections?	☐	☐	☐	☐	☐
Do you think that the HPV vaccine is safe?	☐	☐	☐	☐	☐
Would you like more information on the HPV vaccine?	☐	☐	☐	☐	☐
Do you think that having the HPV vaccine will make other young women in your year at college have sex with more people?	☐	☐	☐	☐	☐
Do you think that having the HPV vaccine will make other young women in your year at college use condoms less often when they have sex?	☐	☐	☐	☐	☐
Do you think that having the HPV vaccine will make other young women in your year at college have more sex?	☐	☐	☐	☐	☐

If you had the HPV vaccine next school year…	Definitely not	Probably not	Not sure	Yes, probably	Yes, definitely
… would you have more sex?	☐	☐	☐	☐	☐
… would you use condoms less often?	☐	☐	☐	☐	☐
… would you have sex with more people?	☐	☐	☐	☐	☐

Your thoughts about HPV	Strongly disagree	Disagree	Not sure	Agree	Strongly agree
I believe that HPV is severe (dangerous)	☐	☐	☐	☐	☐
I believe that HPV has serious negative consequences	☐	☐	☐	☐	☐
I believe that HPV is extremely harmful	☐	☐	☐	☐	☐

Imagine that you never have the HPV vaccine	No chance	Very unlikely	Unlikely	Moderate chance	Likely	Very likely	Certain to happen
If I never have the HPV vaccine, my chance of getting infected with HPV in the future is…	☐	☐	☐	☐	☐	☐	☐
If I never have the HPV vaccine, my chance of getting cervical cancer in the future is…	☐	☐	☐	☐	☐	☐	☐

	Yes	No
Before today, had you heard of HPV?	☐	☐

PLEASE READ THIS BEFORE YOU ANSWER THE NEXT QUESTIONS

Women aged 25-64 years are offered cervical screening (also known as a smear test) every 3-5 years. Cervical screening checks the health of the cervix (neck of the womb), and allows doctors to find changes in the cervix before they can develop into cancer.

During the cervical screening test the doctor or nurse will ask you to lie down on a couch. They will then gently put a small instrument, called a speculum, into your vagina to hold it open. Then they will wipe a small spatula or a brush-like device over the cervix to pick up some cells.

They will transfer these cells into a small container of liquid, and send it away for the cells to be examined under a microscope. The test takes just a few minutes.

Please make sure you've read the information above before answering the next questions

	Yes	No
Before today, had you heard of a smear test?	☐	☐

How much do you agree with the following statements?

	Strongly disagree	Disagree	Not sure	Agree	Strongly agree
When I am older and am invited to go for a smear test, I intend to go	☐	☐	☐	☐	☐
When I am older and am invited to go for a smear test, I will try to go	☐	☐	☐	☐	☐

	Strongly disagree	Disagree	Not sure	Agree	Strongly agree
If I never have the HPV vaccine, I would feel very vulnerable to HPV in the future	☐	☐	☐	☐	☐
If I never have the HPV vaccine, I would feel very vulnerable to cervical cancer in the future	☐	☐	☐	☐	☐

Next, please answer the following questions about HPV	True	False	Not Sure
HPV often has no visible signs or symptoms	☐	☐	☐
If you receive the HPV vaccine you no longer need a smear test	☐	☐	☐
Having many sexual partners increases the risk of getting HPV	☐	☐	☐
HPV always causes genital warts	☐	☐	☐
HPV is related to the AIDS virus	☐	☐	☐
HPV can be transmitted during sexual intercourse	☐	☐	☐
HPV can be treated with antibiotics	☐	☐	☐
HPV is very rare	☐	☐	☐
HPV can cause cervical cancer (cancer of the neck of the womb)	☐	☐	☐
HPV usually goes away without needing any treatment	☐	☐	☐
Most sexually active people will get HPV at some point in their lives	☐	☐	☐
A person always knows if they have HPV	☐	☐	☐
A person could have HPV for many years without knowing it	☐	☐	☐
The HPV vaccine is most effective if given to girls before they first have sex	☐	☐	☐
The HPV vaccine is available on the NHS for 12-13 year old girls	☐	☐	☐
The HPV vaccine protects against all types of cancer	☐	☐	☐
Some HPV vaccines protect against genital warts	☐	☐	☐

Your thoughts about cervical cancer	Strongly disagree	Disagree	Not sure	Agree	Strongly agree
I believe that cervical cancer is severe (dangerous)	☐	☐	☐	☐	☐
I believe that cervical cancer has serious negative consequences	☐	☐	☐	☐	☐
I believe that cervical cancer is extremely harmful	☐	☐	☐	☐	☐

How you feel about talking to your parents (guardians) about sex and contraception	Strongly disagree	Disagree	Not sure	Agree	Strongly agree
I would be embarrassed talking to my parents about sex and contraception	☐	☐	☐	☐	☐
I don't need to talk to my parents about sex and contraception; I know what I need to know	☐	☐	☐	☐	☐
It would make my parents suspicious of me if I tried to talk to them about sex and contraception	☐	☐	☐	☐	☐
My parents would ask me too many personal questions if I tried to talk with them about sex and contraception	☐	☐	☐	☐	☐

Have you and your parents (or guardians) ever talked about …	Yes	No	Can't remember
Sexual intercourse	☐	☐	☐
Condoms	☐	☐	☐
Contraception	☐	☐	☐
Sexually transmitted infections (STIs)	☐	☐	☐
AIDS	☐	☐	☐
HPV vaccines	☐	☐	☐

	None of them	Some of them	Most of them	All of them
Do you think that young women in your year at college have ever had sexual intercourse?	☐	☐	☐	☐
Do you think that young women in your year at college always use a condom when they have sexual intercourse?	☐	☐	☐	☐
	Yes	No	Don't know	
Has your best friend had sexual intercourse?	☐	☐	☐	
Have you had a boyfriend or girlfriend at all since starting secondary school?	☐	☐		

Your sexual health …	Yes	No	Not sure
Have you ever been told by a doctor or nurse that you have a sexually transmitted infection (STI)?	☐	☐	☐
Have you ever thought that you had a STI but did not see a doctor or nurse about it?	☐	☐	☐

	No chance	Very unlikely	Unlikely	Moderate chance	Likely	Very Likely	Certain to happen
If I never have the HPV vaccine, my chance of getting infected with an STI in the future is…	☐	☐	☐	☐	☐	☐	☐

	Strongly disagree	Disagree	Not sure	Agree	Strongly agree
If I never have the HPV vaccine, I would feel very vulnerable to STIs in the future	☐	☐	☐	☐	☐

Your thoughts about sexually transmitted infections (STIs) and sex	Strongly disagree	Disagree	Not sure	Agree	Strongly agree
I believe that STIs are severe (dangerous)	☐	☐	☐	☐	☐
I believe that STIs have serious negative consequences	☐	☐	☐	☐	☐
I believe that STIs are extremely harmful	☐	☐	☐	☐	☐
I believe that having sexual intercourse has serious negative consequences	☐	☐	☐	☐	☐
I believe that having sexual intercourse is extremely harmful	☐	☐	☐	☐	☐
I believe that having sex without using condoms has serious negative consequences	☐	☐	☐	☐	☐
I believe that having sex without using condoms is extremely harmful	☐	☐	☐	☐	☐

PLEASE READ THIS BEFORE YOU ANSWER THE NEXT QUESTIONS

The next questions are about people you have had sexual intercourse with. Please include every person you have ever had sexual intercourse with whether it was just once or a few times or a regular partner.

By sexual intercourse we mean vaginal sex.

Please make sure you've read the information above before answering the next questions

How many people have you ever had sexual intercourse with?

Write the number, or 0 if none: …….

How old were you when you first had sexual intercourse?

……. years old

OR

☐ I have not had sexual intercourse

	Never	Hardly at all	Less than half the time	About half of the time	Most times	Every time	I have never had sex
When you have sexual intercourse how often do you use a condom?	☐	☐	☐	☐	☐	☐	☐

	Not at all true	Somewhat not true	Not sure	Somewhat true	Exactly true
I am certain I can say no to having sexual intercourse this year, even if my partner wants me to	☐	☐	☐	☐	☐
I am certain I can use a condom properly when I next have sexual intercourse	☐	☐	☐	☐	☐

What your friends, family and you think about sex	Strongly disagree	Disagree	Not sure	Agree	Strongly agree
My friends think I should have sexual intercourse this year	☐	☐	☐	☐	☐
My friends think I should use a condom when I next have sexual intercourse	☐	☐	☐	☐	☐
My parents think I should have sexual intercourse this year	☐	☐	☐	☐	☐
My parents think I should only have sexual intercourse once I am married	☐	☐	☐	☐	☐
My parents think I should use a condom when I next have sexual intercourse	☐	☐	☐	☐	☐
I think I should only have sexual intercourse once I am married	☐	☐	☐	☐	☐
In general, I want to do what my friends think I should do	☐	☐	☐	☐	☐
In general, I want to do what my parents think I should do	☐	☐	☐	☐	☐

Sex in the future …	Strongly disagree	Disagree	Not sure	Agree	Strongly agree
I expect I will have sexual intercourse this year	☐	☐	☐	☐	☐
I will definitely have sexual intercourse this year	☐	☐	☐	☐	☐
I intend to use a condom next time I have sexual intercourse	☐	☐	☐	☐	☐
I will definitely use a condom next time I have sexual intercourse	☐	☐	☐	☐	☐

Do you think the following are names of sexually transmitted infections?			
	Yes	No	Not Sure
Tuberculosis	☐	☐	☐
Pneumonia	☐	☐	☐
Chlamydia	☐	☐	☐
Migraine	☐	☐	☐
Gonorrhea	☐	☐	☐
Syphilis	☐	☐	☐
Filaria	☐	☐	☐
HIV (the virus that causes AIDS)	☐	☐	☐

AND FINALLY, A BIT ABOUT YOU …

Which ethnic group do you think that you are in?

☐ White British
☐ White Irish
☐ White Other (please specify)
……
☐ Mixed – White and Black Caribbean
☐ Mixed – White and Black African
☐ Mixed – White and Asian
☐ Mixed Other (please specify)
……
☐ Black or Black British – African
☐ Black or Black British – Caribbean
☐ Black or Black British – Other (please specify)
……

☐ Asian or Asian British - Indian
☐ Asian or Asian British – Pakistani
☐ Asian or Asian British – Bangladeshi
☐ Asian or Asian British – Other (please specify)
……
☐ Chinese or other ethnic group – Chinese
☐ Chinese or other ethnic group – Other (please specify)
……
☐ Other (please specify)
……
☐ Do not wish to answer

What is your religion?

☐ None	☐ Hindu
☐ Buddhist	☐ Jewish
☐ Muslim	☐ Sikh
☐ Christian (Church of England, Protestant, Catholic and all other Christian denominations)	☐ Any other religion (please specify) .....

Would you say you are practising this religion?

Yes, practising	No, not practising	I do not have a religion
☐	☐	☐

How much EMA (educational maintenance allowance) are you normally entitled to receive per week?

£10	£20	£30	I am not entitled to EMA
☐	☐	☐	☐

Who do you live with now?

Please tick (✓) all that apply

My father	☐
My mother	☐
My step-mother	☐
My step-father	☐
My foster mother	☐
My foster father	☐
With carers in a care home	☐
My sisters/brothers	☐
My friends/flatmates	☐
My partner (boyfriend/girlfriend)	☐
My child(ren)	☐
Another man who is not my father	☐
Another woman who is not my mother	☐
Someone else	Please write who.....

	Never	Only a few times a year	About once a month	About once a fortnight	About once a week	About twice a week	Every day or almost every day
How often do you usually have an alcoholic drink?	☐	☐	☐	☐	☐	☐	☐
How often do you take drugs that you did not get from your doctor or chemist (illegal drugs)?	☐	☐	☐	☐	☐	☐	☐

About how many servings of vegetables do you usually eat in a day?

Examples of a serving of vegetables are 2 heaped tablespoons of broccoli or carrots, or 3 tablespoons of sweetcorn or peas, or a bowl of salad. Potatoes DO NOT COUNT as a serving of vegetables.

None	1	2	3	4	5 or more
☐	☐	☐	☐	☐	☐

About how many servings of fruit do you usually eat in a day?

Examples of a serving of fruit are 1 apple or 1 banana or a small bowl of grapes or half a tablespoon of raisins or 3 tablespoons of tinned pears.

None	1	2	3	4	5 or more
☐	☐	☐	☐	☐	☐

Please tick (✓) one box only for each question or write a number if asked to

	Yes	No
Do you smoke?	☐	☐
If yes, how many cigarettes do you smoke a week?	.....	
Do you take the pill (an oral contraceptive)?	☐	☐

How old were you when you first started your periods?

.....years old OR ☐ I have not started my periods

Your experience of cancer…

	Yes	No	Don't know
Has anyone close to you ever been diagnosed with cervical cancer?	☐	☐	☐
Has anyone close to you ever been diagnosed with cancer?	☐	☐	☐
Have you ever been diagnosed with cancer?	☐	☐	☐

END OF THE QUESTIONNAIRE

Thank you for completing this questionnaire. All of your responses are private and will never be linked to your name.

If you finish early have a go at this wordsearch.

It's just for fun though and not part of the study!

Eastenders	**X Factor**	**Neighbours**
Coronation Street	**The Hills**	**Ugly Betty**
Hollyoaks	**Friends**	**One Tree Hill**
Skins	**Waterloo Road**	**Wife Swap**
The Simpsons	**Deal Or No Deal**	**Pimp My Ride**

F	B	D	Y	Q	I	G	M	L	Y	K	H	L	G	R	G	P	V	C	T
D	D	O	R	E	O	I	K	L	X	F	A	C	T	O	R	O	A	J	J
U	G	G	Q	I	N	E	I	G	H	B	O	U	R	S	P	O	G	D	W
B	M	W	R	D	I	D	E	A	L	O	R	N	O	D	E	A	L	N	I
I	O	X	Q	H	O	L	L	Y	O	A	K	S	W	M	B	N	M	T	F
B	A	W	A	X	Y	W	A	T	E	R	L	O	O	R	O	A	D	B	E
X	Q	T	H	E	S	I	M	P	S	O	N	S	A	L	P	G	F	O	S
M	A	C	C	U	N	K	Z	W	D	A	C	T	N	I	E	S	U	E	W
O	O	N	E	T	R	E	E	H	I	L	L	O	N	K	C	D	G	N	A
V	S	T	N	H	E	C	S	H	R	C	J	L	Z	L	R	G	L	Q	P
A	K	A	X	X	V	A	I	K	I	W	S	L	S	R	A	C	Y	X	Y
O	I	Z	T	X	S	T	S	K	T	L	Q	D	W	F	H	N	B	I	X
M	N	J	F	G	R	N	J	T	E	L	K	H	O	A	B	H	E	F	N
A	S	W	S	N	T	I	G	M	E	E	K	R	G	L	Q	K	T	R	Y
J	C	O	R	O	N	A	T	I	O	N	S	T	R	E	E	T	T	I	U
N	S	S	R	X	L	J	T	G	J	D	D	E	L	P	W	I	Y	E	F
L	U	U	D	E	D	S	C	H	W	C	S	E	V	Z	I	E	F	N	N
P	P	I	M	P	M	Y	R	I	D	E	V	I	R	Z	G	D	A	D	C
T	H	E	H	I	L	L	S	W	J	A	Y	C	K	S	C	K	Z	S	D
P	Q	J	O	Z	P	Q	P	H	A	K	K	U	Z	F	B	H	N	W	M

September/October 2009 Participant number .....

Department of Epidemiology and Public Health
Cancer Research UK Health Behaviour Research Centre

UCL

The HPV vaccination and you!

Questionnaire booklet: YOUNG WOMEN

This booklet contains some questions about:

- Vaccinations
- Cervical cancer, human papillomavirus and cervical screening
- Sexual health
- You

It should take about 30 minutes to complete. At times you will be asked to read some information before answering the questions.

Remember, this questionnaire is completely confidential. You don't need to write your name on it. We will not show your responses to your teachers, parents or anyone who knows you.

If you do NOT wish to complete the questionnaire, just return it blank to the researcher.

The questions below will help us match up your questionnaires from year to year without us knowing anything personal about you like your name.

What is your date of birth?	Day	Month	Year
	……	……..	…….
What is your postcode?	……		

How you feel about vaccinations (sometimes called immunisations or injections)
Please tick (✓) one box only for each statement

	Definitely not	Probably not	Not sure	Yes, probably	Yes, definitely
Do you think that vaccinations are necessary to prevent certain diseases?	☐	☐	☐	☐	☐
Do you think that it is important to have vaccinations?	☐	☐	☐	☐	☐
Do you think that vaccinations in general are safe?	☐	☐	☐	☐	☐
Do you think that vaccines are used before scientists know they are safe?	☐	☐	☐	☐	☐
Do you think that vaccines work?	☐	☐	☐	☐	☐
	Not at all scared	Not very scared	Not sure	Quite scared	Very scared
Are you scared of needles?	☐	☐	☐	☐	☐

PLEASE READ THIS BEFORE YOU ANSWER THE NEXT QUESTIONS
Human papillomavirus (HPV) is a very common infection involved in most cervical cancers. It is transmitted via skin-to-skin contact, most commonly during sexual activity. A vaccine has been developed that protects against this infection. This school year you will be offered the HPV vaccine.

Please make sure you've read the information above before answering the next questions

	Yes	No
Are you registered with a GP at the moment?	☐	☐
Before today, had you heard of HPV?	☐	☐

Please tick (✓) the box next to the statement that best describes your situation. Tick one box only	
☐	I have received all three doses of the HPV vaccine
☐	I have received 1 or 2 doses of the HPV vaccine and will complete the course of injections
☐	I have received 1 or 2 doses of the HPV vaccine and will not complete the course of injections
	If so, why is this? .....
☐	I have been offered the HPV vaccine but I haven't yet had it
☐	I have been offered the HPV vaccine but have decided not to have it
☐	I have not been offered the HPV vaccine

How you feel about HPV vaccination

Please tick (✓) one box only for each statement

	Strongly disagree	Disagree	Not sure	Agree	Strongly agree
I will try to have the HPV vaccine	☐	☐	☐	☐	☐
I intend to have the HPV vaccine	☐	☐	☐	☐	☐
My parents will let me have the HPV vaccine	☐	☐	☐	☐	☐

What your friends and family think you should do when you are offered the HPV vaccine

	Strongly disagree	Disagree	Not sure	Agree	Strongly agree
My friends will think I should have the HPV vaccine	☐	☐	☐	☐	☐
My parents will think I should have the HPV vaccine	☐	☐	☐	☐	☐

Would having the HPV vaccine make you …

Use condoms more often than now	Use condoms less often than now	It wouldn't change how often I use condoms
☐	☐	☐

Would having the HPV vaccine make you …

Have sex more often than now	Have sex less often than now	It wouldn't change how often I had sex
☐	☐	☐

What you think about the HPV vaccine

	Definitely not	Probably not	Not sure	Yes, probably	Yes, definitely
Do you think that the HPV vaccine is effective in preventing cervical cancer?	☐	☐	☐	☐	☐
Do you think that the HPV vaccine is effective in preventing HPV infection?	☐	☐	☐	☐	☐
Do you think that the HPV vaccine is effective in preventing sexually transmitted infections?	☐	☐	☐	☐	☐
Do you think that the HPV vaccine is safe?	☐	☐	☐	☐	☐
Would you like more information on the HPV vaccine?	☐	☐	☐	☐	☐

Your thoughts about HPV

	Strongly disagree	Disagree	Not sure	Agree	Strongly agree
I believe that HPV is severe (dangerous)	☐	☐	☐	☐	☐
I believe that HPV has serious negative consequences	☐	☐	☐	☐	☐
I believe that HPV is extremely harmful	☐	☐	☐	☐	☐

Imagine that you never have the HPV vaccine

	No chance	Very unlikely	Unlikely	Moderate chance	Likely	Very likely	Certain to happen
If I never have the HPV vaccine, my chance of getting infected with HPV in the future is…	☐	☐	☐	☐	☐	☐	☐
If I never have the HPV vaccine, my chance of getting cervical cancer in the future is…	☐	☐	☐	☐	☐	☐	☐

	Strongly disagree	Disagree	Not sure	Agree	Strongly agree
If I never have the HPV vaccine, I would feel very vulnerable to HPV in the future	☐	☐	☐	☐	☐
If I never have the HPV vaccine, I would feel very vulnerable to cervical cancer in the future	☐	☐	☐	☐	☐

PLEASE READ THIS BEFORE YOU ANSWER THE NEXT QUESTIONS

Women aged 25-64 years are offered cervical screening (also known as a smear test) every 3-5 years. Cervical screening checks the health of the cervix (neck of the womb), and allows doctors to find changes in the cervix before they can develop into cancer.

During the cervical screening test the doctor or nurse will ask you to lie down on a couch. They will then gently put a small instrument, called a speculum, into your vagina to hold it open. Then they will wipe a small spatula or a brush-like device over the cervix to pick up some cells.

They will transfer these cells into a small container of liquid, and send it away for the cells to be examined under a microscope. The test takes just a few minutes.

Please make sure you've read the information above before answering the next questions

	Yes	No
Before today, had you heard of a smear test?	☐	☐

How much do you agree with the following statements?

	Strongly disagree	Disagree	Not sure	Agree	Strongly agree
When I am older and am invited to go for a smear test, I intend to go	☐	☐	☐	☐	☐
When I am older and am invited to go for a smear test, I will try to go	☐	☐	☐	☐	☐

Next, please answer the following questions about HPV	True	False	Not Sure
HPV often has no visible signs or symptoms	☐	☐	☐
If you receive the HPV vaccine you no longer need a smear test	☐	☐	☐
Having many sexual partners increases the risk of getting HPV	☐	☐	☐
HPV always causes genital warts	☐	☐	☐
HPV is related to the AIDS virus	☐	☐	☐
HPV can be transmitted during sexual intercourse	☐	☐	☐
HPV can be treated with antibiotics	☐	☐	☐
HPV is very rare	☐	☐	☐
HPV can cause cervical cancer (cancer of the neck of the womb)	☐	☐	☐
HPV usually goes away without needing any treatment	☐	☐	☐
Most sexually active people will get HPV at some point in their lives	☐	☐	☐
A person always knows if they have HPV	☐	☐	☐
A person could have HPV for many years without knowing it	☐	☐	☐
The HPV vaccine is most effective if given to girls before they first have sex	☐	☐	☐
The HPV vaccine is available on the NHS for 12-13 year old girls	☐	☐	☐
The HPV vaccine protects against all types of cancer	☐	☐	☐
Some HPV vaccines protect against genital warts	☐	☐	☐

Your thoughts about cervical cancer	Strongly disagree	Disagree	Not sure	Agree	Strongly agree
I believe that cervical cancer is severe (dangerous)	☐	☐	☐	☐	☐
I believe that cervical cancer has serious negative consequences	☐	☐	☐	☐	☐
I believe that cervical cancer is extremely harmful	☐	☐	☐	☐	☐

How you feel about talking to your parents (guardians) about sex and contraception	Strongly disagree	Disagree	Not sure	Agree	Strongly agree
I would be embarrassed talking to my parents about sex and contraception	☐	☐	☐	☐	☐
I don't need to talk to my parents about sex and contraception; I know what I need to know	☐	☐	☐	☐	☐
It would make my parents suspicious of me if I tried to talk to them about sex and contraception	☐	☐	☐	☐	☐
My parents would ask me too many personal questions if I tried to talk with them about sex and contraception	☐	☐	☐	☐	☐

Have you and your parents (or guardians) ever talked about …	Yes	No	Can't remember
Sexual intercourse	☐	☐	☐
Condoms	☐	☐	☐
Contraception	☐	☐	☐
Sexually transmitted infections (STIs)	☐	☐	☐
AIDS	☐	☐	☐
HPV vaccines	☐	☐	☐

	None of them	Some of them	Most of them	All of them
Do you think that young women in your year at college have ever had sexual intercourse?	☐	☐	☐	☐
Do you think that young women in your year at college always use a condom when they have sexual intercourse?	☐	☐	☐	☐
	Yes	No	Don't know	
Has your best friend had sexual intercourse?	☐	☐	☐	
Have you had a boyfriend or girlfriend at all since starting secondary school?	☐	☐		

Your sexual health …			
	Yes	No	Not sure
Have you ever been told by a doctor or nurse that you have a sexually transmitted infection (STI)?	☐	☐	☐
Have you ever thought that you had a STI but did not see a doctor or nurse about it?	☐	☐	☐

	No chance	Very unlikely	Unlikely	Moderate chance	Likely	Very Likely	Certain to happen
If I never have the HPV vaccine, my chance of getting infected with an STI in the future is…	☐	☐	☐	☐	☐	☐	☐
	Strongly disagree	Disagree	Not sure	Agree	Strongly agree		
If I never have the HPV vaccine, I would feel very vulnerable to STIs in the future	☐	☐	☐	☐	☐		

Your thoughts about STIs and sex					
	Strongly disagree	Disagree	Not sure	Agree	Strongly agree
I believe that STIs are severe (dangerous)	☐	☐	☐	☐	☐
I believe that STIs have serious negative consequences	☐	☐	☐	☐	☐

	Strongly disagree	Disagree	Not sure	Agree	Strongly agree
I believe that STIs are extremely harmful	☐	☐	☐	☐	☐
I believe that having sexual intercourse has serious negative consequences	☐	☐	☐	☐	☐
I believe that having sexual intercourse is extremely harmful	☐	☐	☐	☐	☐
I believe that having sex without using condoms has serious negative consequences	☐	☐	☐	☐	☐
I believe that having sex without using condoms is extremely harmful	☐	☐	☐	☐	☐

PLEASE READ THIS BEFORE YOU ANSWER THE NEXT QUESTIONS

The next questions are about people you have had sexual intercourse with. Please include every person you have ever had sexual intercourse with whether it was just once or a few times or a regular partner.

By sexual intercourse we mean vaginal sex.

Please make sure you've read the information above before answering the next questions

How many people have you ever had sexual intercourse with?

Write the number, or 0 if none: .....

How old were you when you first had sexual intercourse?

..... years old

OR

☐ I have not had sexual intercourse

	Never	Hardly at all	Less than half the time	About half of the time	Most times	Every time	I have never had sex
When you have sexual intercourse how often do you use a condom?	☐	☐	☐	☐	☐	☐	☐

	Not at all true	Somewhat not true	Not sure	Somewhat true	Exactly true
I am certain I can say no to having sexual intercourse this year, even if my partner wants me to	☐	☐	☐	☐	☐
I am certain I can use a condom properly when I next have sexual intercourse	☐	☐	☐	☐	☐

What your friends, family and you think about sex	Strongly disagree	Disagree	Not sure	Agree	Strongly agree
My friends think I should have sexual intercourse this year	☐	☐	☐	☐	☐
My friends think I should use a condom when I next have sexual intercourse	☐	☐	☐	☐	☐
My parents think I should have sexual intercourse this year	☐	☐	☐	☐	☐
My parents think I should only have sexual intercourse once I am married	☐	☐	☐	☐	☐
My parents think I should use a condom when I next have sexual intercourse	☐	☐	☐	☐	☐
I think I should only have sexual intercourse once I am married	☐	☐	☐	☐	☐
In general, I want to do what my friends think I should do	☐	☐	☐	☐	☐
In general, I want to do what my parents think I should do	☐	☐	☐	☐	☐

Sex in the future …	Strongly disagree	Disagree	Not sure	Agree	Strongly agree
I expect I will have sexual intercourse this year	☐	☐	☐	☐	☐
I will definitely have sexual intercourse this year	☐	☐	☐	☐	☐
I intend to use a condom next time I have sexual intercourse	☐	☐	☐	☐	☐
I will definitely use a condom next time I have sexual intercourse	☐	☐	☐	☐	☐

Do you think the following are names of sexually transmitted infections?			
	Yes	No	Not Sure
Tuberculosis	☐	☐	☐
Pneumonia	☐	☐	☐
Chlamydia	☐	☐	☐
Migraine	☐	☐	☐
Gonorrhea	☐	☐	☐
Syphilis	☐	☐	☐
Filaria	☐	☐	☐
HIV (the virus that causes AIDS)	☐	☐	☐

AND FINALLY, A BIT ABOUT YOU …

Which ethnic group do you think that you are in?

☐ White British

☐ White Irish

☐ White Other (please specify)

……

☐ Mixed – White and Black Caribbean

☐ Mixed – White and Black African

☐ Mixed – White and Asian

☐ Mixed Other (please specify)

……

☐ Black or Black British – African

☐ Black or Black British – Caribbean

☐ Black or Black British – Other (please specify)

……

☐ Asian or Asian British - Indian

☐ Asian or Asian British – Pakistani

☐ Asian or Asian British – Bangladeshi

☐ Asian or Asian British – Other (please specify)

……

☐ Chinese or other ethnic group – Chinese

☐ Chinese or other ethnic group – Other (please specify)

……

☐ Other (please specify)

……

☐ Do not wish to answer

What is your religion?

☐	None	☐	Hindu
☐	Buddhist	☐	Jewish
☐	Muslim	☐	Sikh
☐	Christian (Church of England, Protestant, Catholic and all other Christian denominations)	☐	Any other religion (please specify) .....

Would you say you are practising this religion?

Yes, practising	No, not practising	I do not have a religion
☐	☐	☐

	Never	Only a few times a year	About once a month	About once a fortnight	About once a week	About twice a week	Every day or almost every day
How often do you usually have an alcoholic drink?	☐	☐	☐	☐	☐	☐	☐
How often do you take drugs that you did not get from your doctor or chemist (illegal drugs)?	☐	☐	☐	☐	☐	☐	☐

How much EMA (educational maintenance allowance) are you normally entitled to receive per week?

£30	£20	£10	I am not entitled to EMA
☐	☐	☐	☐

About how many servings of vegetables do you usually eat in a day?

Examples of a serving of vegetables are 2 heaped tablespoons of broccoli or carrots, or 3 tablespoons of sweetcorn or peas, or a bowl of salad. Potatoes DO NOT COUNT as a serving of vegetables.

None	1	2	3	4	5 or more
☐	☐	☐	☐	☐	☐

About how many servings of fruit do you usually eat in a day?

Examples of a serving of fruit are 1 apple or 1 banana or a small bowl of grapes or half a tablespoon of raisins or 3 tablespoons of tinned pears.

None	1	2	3	4	5 or more
☐	☐	☐	☐	☐	☐

Please tick (✓) one box only for each question or write a number if asked to		
	Yes	No
Do you smoke?	☐	☐
If yes, how many cigarettes do you smoke a week?	…….	
Do you take the pill (an oral contraceptive)?	☐	☐

What school year are you in?	
Year 12	Year 13
☐	☐

How old were you when you first started your periods?

…….years old OR ☐ I have not started my periods

Your experience of cancer…			
	Yes	No	Don't know
Has anyone close to you ever been diagnosed with cervical cancer?	☐	☐	☐
Has anyone close to you ever been diagnosed with cancer?	☐	☐	☐
Have you ever been diagnosed with cancer?	☐	☐	☐

END OF THE QUESTIONNAIRE

Thank you for completing this questionnaire. All of your responses are private and will never be linked to your name.

If you finish early have a go at this wordsearch.

It's just for fun though and not part of the study!

Lion	**Rhino**	**Vulture**
Monkey	**Ostrich**	**Buffalo**
Elephant	**Crocodile**	**Giraffe**
Zebra	**Panther**	**Hippopotamus**
Cheetah	**Tiger**	**Scorpion**

L	K	B	H	T	T	B	Q	V	V	C	I	V	E	H	R	S	Q	V	U
L	L	R	L	P	Z	W	H	J	B	C	X	U	S	O	H	E	O	M	M
S	I	A	X	H	U	P	T	E	X	H	O	L	E	Y	I	F	M	T	Y
L	H	X	L	S	O	T	X	J	U	W	D	T	C	F	D	C	M	L	N
C	R	O	C	O	D	I	L	E	K	R	A	U	G	S	B	K	B	N	Y
Z	L	K	J	U	K	Q	B	E	V	X	I	R	I	N	U	W	F	Z	H
T	F	I	I	A	Z	E	B	R	A	W	V	E	U	Z	F	J	H	L	B
E	A	R	O	A	V	Y	T	I	G	E	R	Z	K	C	F	T	M	E	Z
G	P	C	E	N	G	I	R	A	F	F	E	W	U	U	A	H	K	Q	V
F	X	C	O	O	V	B	I	Q	C	Q	W	R	H	S	L	Y	G	O	F
P	A	S	D	S	C	O	R	P	I	O	N	A	Q	G	O	R	U	M	M
A	Q	U	T	K	V	V	X	W	K	W	G	S	E	O	W	P	S	L	X
N	M	O	N	K	E	Y	E	W	E	L	E	P	H	A	N	T	N	S	F
T	Q	D	C	X	M	H	W	B	O	V	Z	I	X	M	V	M	V	B	V
H	R	Z	H	O	O	E	A	N	F	X	O	S	T	R	I	C	H	H	Q
E	C	B	O	T	C	H	E	E	T	A	H	S	T	A	J	C	Z	E	D
R	I	P	N	S	G	Q	K	J	U	S	B	G	I	O	N	S	L	U	Q
E	G	F	R	H	I	N	O	W	H	I	S	D	S	U	R	S	S	U	E
G	Z	Q	H	H	I	P	P	O	P	O	T	A	M	U	S	G	P	M	Y
V	K	A	H	L	D	G	H	X	I	I	A	W	C	S	G	J	N	M	R

March 2010 Participant number .....

Department of Epidemiology and Public Health
Cancer Research UK Health Behaviour Research Centre

The HPV vaccination and you!

Questionnaire booklet: YOUNG WOMEN

This booklet contains some questions about:

- Vaccinations
- Cervical cancer, human papillomavirus and cervical screening
- Sexual health
- You

It should take about 30 minutes to complete. At times you will be asked to read some information before answering the questions.

Remember, this questionnaire is completely confidential. You don't need to write your name on it. We will not show your responses to your teachers, parents or anyone who knows you.

If you do NOT wish to complete the questionnaire, just return it blank to the researcher.

The questions below will help us match up your questionnaires from year to year without us knowing anything personal about you like your name.

What is your date of birth?	Day	Month	Year
	.....	.....	.....
What is your postcode?	.....		

How you feel about vaccinations (sometimes called immunisations or injections)
Please tick (✓) one box only for each statement

	Definitely not	Probably not	Not sure	Yes, probably	Yes, definitely
Do you think that vaccinations are necessary to prevent certain diseases?	☐	☐	☐	☐	☐
Do you think that it is important to have vaccinations?	☐	☐	☐	☐	☐
Do you think that vaccinations in general are safe?	☐	☐	☐	☐	☐
Do you think that vaccines are used before scientists know they are safe?	☐	☐	☐	☐	☐
Do you think that vaccines work?	☐	☐	☐	☐	☐
	Not at all scared	Not very scared	Not sure	Quite scared	Very scared
Are you scared of needles?	☐	☐	☐	☐	☐

PLEASE READ THIS BEFORE YOU ANSWER THE NEXT QUESTIONS
Human papillomavirus (HPV) is a very common infection involved in most cervical cancers. It is transmitted via skin-to-skin contact, most commonly during sexual activity. A vaccine has been developed that protects against this infection. This school year you are being offered the HPV vaccine.

Please make sure you've read the information above before answering the next questions

	Yes	No
Are you registered with a GP at the moment?	☐	☐
Before today, had you heard of HPV?	☐	☐

Please tick (✓) the box next to the statement that best describes your situation. Tick one box only

- ☐ I have received all three doses of the HPV vaccine
- ☐ I have received 1 or 2 doses of the HPV vaccine and will complete the course of injections
- ☐ I have received 1 or 2 doses of the HPV vaccine and will not complete the course of injections
  If so, why is this? .....
- ☐ I have been offered the HPV vaccine but I haven't yet had it
  If so, why is this? .....
- ☐ I have been offered the HPV vaccine but have decided not to have it
  If so, why is this? .....
- ☐ I have not been offered the HPV vaccine

How you feel about HPV vaccination

Please tick (✓) one box only for each statement

	Strongly disagree	Disagree	Not sure	Agree	Strongly agree
I will try to have the HPV vaccine	☐	☐	☐	☐	☐
I intend to have the HPV vaccine	☐	☐	☐	☐	☐
My parents will let me have the HPV vaccine	☐	☐	☐	☐	☐

What your friends & family think you should do when you're offered the HPV vaccine

	Strongly disagree	Disagree	Not sure	Agree	Strongly agree
My friends will think I should have the HPV vaccine	☐	☐	☐	☐	☐
My parents will think I should have the HPV vaccine	☐	☐	☐	☐	☐

Would having the HPV vaccine make you …

Use condoms more often than now	Use condoms less often than now	It wouldn't change how often I use condoms
☐	☐	☐

Would having the HPV vaccine make you …

Have sex more often than now	Have sex less often than now	It wouldn't change how often I had sex
☐	☐	☐

What you think about the HPV vaccine	Definitely not	Probably not	Not sure	Yes, probably	Yes, definitely
Do you think that the HPV vaccine is effective in preventing cervical cancer?	☐	☐	☐	☐	☐
Do you think that the HPV vaccine is effective in preventing HPV infection?	☐	☐	☐	☐	☐
Do you think that the HPV vaccine is effective in preventing sexually transmitted infections?	☐	☐	☐	☐	☐
Do you think that the HPV vaccine is safe?	☐	☐	☐	☐	☐
Would you like more information on the HPV vaccine?	☐	☐	☐	☐	☐

Your thoughts about HPV	Strongly disagree	Disagree	Not sure	Agree	Strongly agree
I believe that HPV is severe (dangerous)	☐	☐	☐	☐	☐
I believe that HPV has serious negative consequences	☐	☐	☐	☐	☐
I believe that HPV is extremely harmful	☐	☐	☐	☐	☐

Your thoughts about the future	No chance	Very unlikely	Unlikely	Moderate chance	Likely	Very likely	Certain to happen
My chance of getting infected with HPV in the future is…	☐	☐	☐	☐	☐	☐	☐
My chance of getting cervical cancer in the future is…	☐	☐	☐	☐	☐	☐	☐

	Strongly disagree	Disagree	Not sure	Agree	Strongly agree
I feel very vulnerable to HPV in the future	☐	☐	☐	☐	☐
I feel very vulnerable to cervical cancer in the future	☐	☐	☐	☐	☐

PLEASE READ THIS BEFORE YOU ANSWER THE NEXT QUESTIONS

Women aged 25-64 years are offered cervical screening (also known as a smear test) every 3-5 years. Cervical screening checks the health of the cervix (neck of the womb), and allows doctors to find changes in the cervix before they can develop into cancer.

During the cervical screening test the doctor or nurse will ask you to lie down on a couch. They will then gently put a small instrument, called a speculum, into your vagina to hold it open. Then they will wipe a small spatula or a brush-like device over the cervix to pick up some cells.

They will transfer these cells into a small container of liquid, and send it away for the cells to be examined under a microscope. The test takes just a few minutes.

Please make sure you've read the information above before answering the next questions

	Yes	No
Before today, had you heard of a smear test?	☐	☐

How much do you agree with the following statements?

	Strongly disagree	Disagree	Not sure	Agree	Strongly agree
When I am older and am invited to go for a smear test, I intend to go	☐	☐	☐	☐	☐
When I am older and am invited to go for a smear test, I will try to go	☐	☐	☐	☐	☐

Next, please answer the following questions about HPV	True	False	Not Sure
HPV often has no visible signs or symptoms	☐	☐	☐
If you receive the HPV vaccine you no longer need a smear test	☐	☐	☐
Having many sexual partners increases the risk of getting HPV	☐	☐	☐
HPV always causes genital warts	☐	☐	☐
HPV is related to the AIDS virus	☐	☐	☐
HPV can be transmitted during sexual intercourse	☐	☐	☐
HPV can be treated with antibiotics	☐	☐	☐
HPV is very rare	☐	☐	☐
HPV can cause cervical cancer (cancer of the neck of the womb)	☐	☐	☐
HPV usually goes away without needing any treatment	☐	☐	☐
Most sexually active people will get HPV at some point in their lives	☐	☐	☐
A person always knows if they have HPV	☐	☐	☐
A person could have HPV for many years without knowing it	☐	☐	☐
The HPV vaccine is most effective if given to girls before they first have sex	☐	☐	☐
The HPV vaccine is available on the NHS for 12-13 year old girls	☐	☐	☐
The HPV vaccine protects against all types of cancer	☐	☐	☐
Some HPV vaccines protect against genital warts	☐	☐	☐

Your thoughts about cervical cancer	Strongly disagree	Disagree	Not sure	Agree	Strongly agree
I believe that cervical cancer is severe (dangerous)	☐	☐	☐	☐	☐
I believe that cervical cancer has serious negative consequences	☐	☐	☐	☐	☐
I believe that cervical cancer is extremely harmful	☐	☐	☐	☐	☐

How you feel about talking to your parents (guardians) about sex and contraception	Strongly disagree	Disagree	Not sure	Agree	Strongly agree
I would be embarrassed talking to my parents about sex and contraception	☐	☐	☐	☐	☐
I don't need to talk to my parents about sex and contraception; I know what I need to know	☐	☐	☐	☐	☐
It would make my parents suspicious of me if I tried to talk to them about sex and contraception	☐	☐	☐	☐	☐
My parents would ask me too many personal questions if I tried to talk with them about sex and contraception	☐	☐	☐	☐	☐

Have you and your parents (or guardians) ever talked about …	Yes	No	Can't remember
Sexual intercourse	☐	☐	☐
Condoms	☐	☐	☐
Contraception	☐	☐	☐
Sexually transmitted infections (STIs)	☐	☐	☐
AIDS	☐	☐	☐
HPV vaccines	☐	☐	☐

	None of them	Some of them	Most of them	All of them
Do you think that young women in your year at college have ever had sexual intercourse?	☐	☐	☐	☐
Do you think that young women in your year at college always use a condom when they have sexual intercourse?	☐	☐	☐	☐
	Yes	No	Don't know	
Has your best friend had sexual intercourse?	☐	☐	☐	
Have you had a boyfriend or girlfriend at all since starting secondary school?	☐	☐		

Your sexual health …	Yes	No	Not sure
Have you ever been told by a doctor or nurse that you have a sexually transmitted infection (STI)?	☐	☐	☐
Have you ever thought that you had a STI but did not see a doctor or nurse about it?	☐	☐	☐

	No chance	Very unlikely	Unlikely	Moderate chance	Likely	Very Likely	Certain to happen
My chance of getting infected with an STI in the future is…	☐	☐	☐	☐	☐	☐	☐

	Strongly disagree	Disagree	Not sure	Agree	Strongly agree
I feel very vulnerable to STIs in the future	☐	☐	☐	☐	☐

Your thoughts about STIs and sex	Strongly disagree	Disagree	Not sure	Agree	Strongly agree
I believe that STIs are severe (dangerous)	☐	☐	☐	☐	☐
I believe that STIs have serious negative consequences	☐	☐	☐	☐	☐

	Strongly disagree	Disagree	Not sure	Agree	Strongly agree
I believe that STIs are extremely harmful	☐	☐	☐	☐	☐
I believe that having sexual intercourse has serious negative consequences	☐	☐	☐	☐	☐
I believe that having sexual intercourse is extremely harmful	☐	☐	☐	☐	☐
I believe that having sex without using condoms has serious negative consequences	☐	☐	☐	☐	☐
I believe that having sex without using condoms is extremely harmful	☐	☐	☐	☐	☐

PLEASE READ THIS BEFORE YOU ANSWER THE NEXT QUESTIONS

The next questions are about people you have had sexual intercourse with. Please include every person you have ever had sexual intercourse with whether it was just once or a few times or a regular partner.

By sexual intercourse we mean vaginal sex.

Please make sure you've read the information above before answering the next questions

How many people have you ever had sexual intercourse with?

Write the number, or 0 if none: …….

How old were you when you first had sexual intercourse?

……. years old

OR

☐ I have not had sexual intercourse

	Never	Hardly at all	Less than half the time	About half of the time	Most times	Every time	I have never had sex
When you have sexual intercourse how often do you use a condom?	☐	☐	☐	☐	☐	☐	☐

	Not at all true	Somewhat not true	Not sure	Somewhat true	Exactly true
I am certain I can say no to having sexual intercourse this year, even if my partner wants me to	☐	☐	☐	☐	☐
I am certain I can use a condom properly when I next have sexual intercourse	☐	☐	☐	☐	☐

What your friends, family and you think about sex	Strongly disagree	Disagree	Not sure	Agree	Strongly agree
My friends think I should have sexual intercourse this year	☐	☐	☐	☐	☐
My friends think I should use a condom when I next have sexual intercourse	☐	☐	☐	☐	☐
My parents think I should have sexual intercourse this year	☐	☐	☐	☐	☐
My parents think I should only have sexual intercourse once I am married	☐	☐	☐	☐	☐
My parents think I should use a condom when I next have sexual intercourse	☐	☐	☐	☐	☐
I think I should only have sexual intercourse once I am married	☐	☐	☐	☐	☐
In general, I want to do what my friends think I should do	☐	☐	☐	☐	☐
In general, I want to do what my parents think I should do	☐	☐	☐	☐	☐

Sex in the future …	Strongly disagree	Disagree	Not sure	Agree	Strongly agree
I expect I will have sexual intercourse this year	☐	☐	☐	☐	☐
I will definitely have sexual intercourse this year	☐	☐	☐	☐	☐
I intend to use a condom next time I have sexual intercourse	☐	☐	☐	☐	☐
I will definitely use a condom next time I have sexual intercourse	☐	☐	☐	☐	☐

Do you think the following are names of sexually transmitted infections?			
	Yes	No	Not Sure
Tuberculosis	☐	☐	☐
Pneumonia	☐	☐	☐
Chlamydia	☐	☐	☐
Migraine	☐	☐	☐
Gonorrhea	☐	☐	☐
Syphilis	☐	☐	☐
Filaria	☐	☐	☐
HIV (the virus that causes AIDS)	☐	☐	☐

AND FINALLY, A BIT ABOUT YOU …

Which ethnic group do you think that you are in?

☐ White British
☐ White Irish
☐ White Other (please specify)
……
☐ Mixed – White and Black Caribbean
☐ Mixed – White and Black African
☐ Mixed – White and Asian
☐ Mixed Other (please specify)
……
☐ Black or Black British – African
☐ Black or Black British – Caribbean
☐ Black or Black British – Other (please specify)
……
☐ Asian or Asian British - Indian
☐ Asian or Asian British – Pakistani
☐ Asian or Asian British – Bangladeshi
☐ Asian or Asian British – Other (please specify)
……
☐ Chinese or other ethnic group – Chinese
☐ Chinese or other ethnic group – Other (please specify)
……
☐ Other (please specify)
……
☐ Do not wish to answer

What is your religion?

☐	None	☐	Hindu
☐	Buddhist	☐	Jewish
☐	Muslim	☐	Sikh
☐	Christian (Church of England, Protestant, Catholic and all other Christian denominations)	☐	Any other religion (please specify) .....

Would you say you are practising this religion?

Yes, practising	No, not practising	I do not have a religion
☐	☐	☐

	Never	Only a few times a year	About once a month	About once a fortnight	About once a week	About twice a week	Every day or almost every day
How often do you usually have an alcoholic drink?	☐	☐	☐	☐	☐	☐	☐
How often do you take drugs that you did not get from your doctor or chemist (illegal drugs)?	☐	☐	☐	☐	☐	☐	☐

How much EMA (educational maintenance allowance) are you normally entitled to receive per week?

£30	£20	£10	I am not entitled to EMA
☐	☐	☐	☐

About how many servings of <u>vegetables</u> do you usually eat in a day?

Examples of a serving of vegetables are 2 heaped tablespoons of broccoli or carrots, or 3 tablespoons of sweetcorn or peas, or a bowl of salad. Potatoes DO NOT COUNT as a serving of vegetables.

None	1	2	3	4	5 or more
☐	☐	☐	☐	☐	☐

About how many servings of <u>fruit</u> do you usually eat in a day?

Examples of a serving of fruit are 1 apple or 1 banana or a small bowl of grapes or half a tablespoon of raisins or 3 tablespoons of tinned pears.

None	1	2	3	4	5 or more
☐	☐	☐	☐	☐	☐

Please tick (✓) one box only for each question or write a number if asked to		
	Yes	No
Do you smoke?	☐	☐
If yes, how many cigarettes do you smoke a week?	…….	
Do you take the pill (an oral contraceptive)?	☐	☐

What school year are you in?	
Year 12	Year 13
☐	☐

How old were you when you first started your periods?

…….years old OR ☐ I have not started my periods

Your experience of cancer…			
	Yes	No	Don't know
Has anyone close to you ever been diagnosed with cervical cancer?	☐	☐	☐
Has anyone close to you ever been diagnosed with cancer?	☐	☐	☐
Have you ever been diagnosed with cancer?	☐	☐	☐

END OF THE QUESTIONNAIRE

Thank you for completing this questionnaire. All of your responses are private and will never be linked to your name.

If you finish early have a go at this wordsearch.

It's just for fun though and not part of the study!

Lady Gaga	**Justin Timberlake**	**Katy Perry**
Flo Rida	**Kings of Leon**	**Britney Spears**
Jason Mraz	**Rhianna**	**Jordin Sparks**
Beyonce	**Alexandra Burke**	**JLS**
Kanye West	**N-Dubz**	**The Saturdays**

B	R	I	T	N	E	Y	S	P	E	A	R	S	C	R	W	R	B	B	A
H	P	E	M	S	N	C	W	U	X	D	G	X	S	J	R	L	V	D	E
N	R	Y	K	K	U	J	Z	Y	H	F	N	V	M	J	D	D	M	C	R
M	Y	A	O	T	A	U	Y	V	W	U	S	Z	K	W	X	N	X	M	P
Q	T	C	X	H	O	S	E	O	J	O	J	H	T	O	O	D	G	F	J
L	D	Q	F	E	N	T	D	Y	L	M	O	Y	E	F	I	U	V	R	Y
A	P	W	O	S	J	I	R	M	S	S	A	T	Y	T	L	B	A	Q	Q
D	C	H	F	A	O	N	H	B	E	Y	O	N	C	E	L	Z	T	B	K
Y	S	G	R	T	R	T	I	Z	M	R	G	N	Z	J	Y	G	S	R	I
G	J	D	R	U	D	I	A	A	T	N	I	K	S	L	B	K	D	H	N
A	W	L	J	R	I	M	N	Q	Z	T	O	U	Y	R	Y	A	W	C	G
G	V	M	A	D	N	B	N	N	U	O	V	F	H	Z	G	N	Y	P	S
A	E	R	S	A	S	E	A	K	A	T	Y	P	E	R	R	Y	G	T	O
I	N	F	O	Y	P	R	Y	J	F	J	J	C	I	J	E	E	R	Y	F
S	R	F	N	S	A	L	V	Y	Y	L	A	V	P	E	Q	W	V	V	L
I	Q	N	M	A	R	A	V	B	H	A	O	Q	E	T	Y	E	S	L	E
C	K	L	R	E	K	K	Q	O	I	G	O	R	T	U	F	S	T	F	O
Y	S	J	A	O	S	E	C	N	B	T	O	I	I	O	C	T	J	Y	N
C	N	M	Z	W	F	N	Y	K	E	Z	A	H	M	D	B	B	U	F	P
A	L	E	X	A	N	D	R	A	B	U	R	K	E	I	A	C	C	X	U

APPENDIX 18 - ETHICAL APPROVAL FOR CHAPTER 7

UCL RESEARCH ETHICS COMMITTEE
GRADUATE SCHOOL OFFICE

Professor Jane Wardle
Director of Cancer Research UK Health Behaviour Research Centre
Health Behaviour Research Centre
UCL
2-16 Torrington Place
London
WC1E 6BT

05 February 2009

Dear Professor Wardle

Notification of Ethical Approval
Ethics Application: 1399/003: Young women's participation in the human papillomavirus immunisation programme: 'HPV vaccination and you!'

I am pleased to confirm that the UCL Research Ethics Committee has approved your study for the duration of the project.

Ethical approval is subject to the following conditions:

1. You must seek Chair's approval for proposed amendments to the research for which this approval has been given. Ethical approval is specific to this project and must not be treated as applicable to research of a similar nature. Each research project is reviewed separately and if there are significant changes to the research protocol you should seek confirmation of continued ethical approval by completing the 'Amendment Approval Request Form' which can be downloaded from the ethics website: http://www.grad.ucl.ac.uk/ethics/responsibilities.php

2. It is your responsibility to report to the Committee any unanticipated problems or adverse events involving risks to participants or others. Both non-serious and serious adverse events must be reported.

   Reporting Non-Serious Adverse Events
   For non-serious adverse events you will need to inform Ms Helen Dougal, Ethics Committee Administrator (h.dougal@ucl.ac.uk), within ten days of an adverse incident occurring and provide a full written report that should include any amendments to the participant information sheet and study protocol.

   Reporting Serious Adverse Events
   The Ethics Committee should be notified of all serious adverse events via the Ethics Committee Administrator immediately the incident occurs. Where the adverse incident is unexpected and serious, the Chair or Vice-Chair will decide whether the study should be terminated pending the opinion of an independent expert.

On completion of the research you must submit a brief report (a maximum of two sides of A4) of your findings/concluding comments to the Committee, which includes in particular issues relating to the ethical implications of the research.

Yours sincerely

Sir John Birch
Chair of the UCL Research Ethics Committee

Cc: Alice Forster and Dr Jo Waller, Health Behaviour Research Centre, UCL

UCL Research Ethics Committee, c/o The Graduate School, North Cloisters, Wilkins Building
University College London Gower Street London WC1E 6BT
Tel: +44 (0)20 7679 7844 Fax: +44 (0)20 7679 7043

APPENDIX 19 – MISSING DATA FOR THE PROSPECTIVE STUDY AND QUASI CROSS-SECTIONAL STUDY IN CHAPTER 7

Variable	Missing n (%)
PROSPECTIVE STUDY	
Choosing an appropriate measure of risk – *Follow-up measures*	
I feel very vulnerable to HPV in the future	12 (1.5)
I feel very vulnerable to cervical cancer in the future	13 (1.7)
I feel very vulnerable to STIs in the future	17 (2.2)
My chance of getting infected with HPV in the future is …	13 (1.7)
My chance of getting infected with cervical cancer in the future is …	16 (2.0)
My chance of getting infected with an STI in the future is …	17 (2.2)
Vaccination receipt	16 (2.0)
Comparing differences in changes in the dependent variables	
Follow-up measures	
Vaccination receipt	4 (1.0)
I feel very vulnerable to cervical cancer in the future	6 (1.5)
I feel very vulnerable to HPV in the future	6 (1.5)
I feel very vulnerable to STIs in the future	11 (2.7)
Communication about sex with parents	11 (2.7)
Number of sexual partners	49 (12.0)
Age of sexual debut	41 (9.6)
Condom use	26 (6.4)
Had sex?	12 (3.0)
Subjective norm for my parents think I should only have sex this year	19 (4.7)
Subjective norm for my friends think I should only have sex this year	18 (4.4)
Subjective norm for my parents think I should use a condom when I next have sexual intercourse	25 (6.1)
Subjective norm for my friends think I should use a condom when I next have sexual intercourse	19 (4.7)
Ethnicity	10 (2.5)
Religion	8 (2.0)
Are you practicing that religion?	18 (4.4)
EMA	1 (0.3)
Oral contraceptive use	16 (3.9)
Age	0 (0.0)
Intention to attend cervical cancer screening	4 (1.0)
Drug use	21 (5.2)
Ever had a boyfriend	4 (1.0)
Do you smoke?	12 (3.0)
Baseline measures	
If I never have the HPV vaccine, I would feel very vulnerable to STIs in the future	10 (2.5)
If I never have the HPV vaccine, I would feel very vulnerable to cervical cancer in the future	4 (1.0)
If I never have the HPV vaccine, I would feel very vulnerable to HPV in the future	3 (0.7)
Number of sexual partners	29 (7.1)
Condom use	26 (6.4)
Communication about sex with parents	6 (1.5)

Variable	Missing n (%)
Had sex?	12 (3.0)
Age of sexual debut	32 (7.9)
Intention to attend cervical cancer screening	5 (1.2)
QUASI CROSS-SECTIONAL STUDY	
Vaccination receipt	0 (0)
Intention to attend cervical cancer screening	11 (2.2)
Condom use	17 (7.1)
Number of sexual partner	22 (4.5)
Communication about sex with parents	8 (1.6)
Subjective norm for my friends think I should use a condom when I next have sexual intercourse	11 (2.2)
Subjective norm for my parents think I should use a condom when I next have sexual intercourse	19 (3.9)
Subjective norm for my friends think I should only have sex this year	8 (1.6)
Subjective norm for my parents think I should only have sex this year	10 (2.0)
Drug use	13 (2.6)
Ever had a boyfriend	7 (1.4)
Do you smoke?	10 (2.0)
Feeling of risk for HPV	8 (1.6)
Feeling of risk for cervical cancer	9 (1.8)
Feeling of risk for STIs	11 (2.2)
Had sex?	18 (3.5)
Age of sexual debut	28 (5.7)
Ethnicity	12 (2.4)
Religion	11 (2.2)
Are you practicing that religion?	22 (4.5)
EMA	12 (2.4)
Oral contraceptive use	22 (4.5)
Age	31 (6.3)